VOLUME XXIX NUMBER SIX

THE NATIONAL GEOGRAPHIC MAGAZINE

JUNE, 1916

CONTENTS

16 Pages in Four Colors

The Wild Blueberry Tamed
With 10 Illustrations — FREDERICK V. COVILLE

America's Surpassing Fisheries
With 35 Illustrations — HUGH M. SMITH

Common American Wild Flowers
With 17 Illustrations in Four Colors

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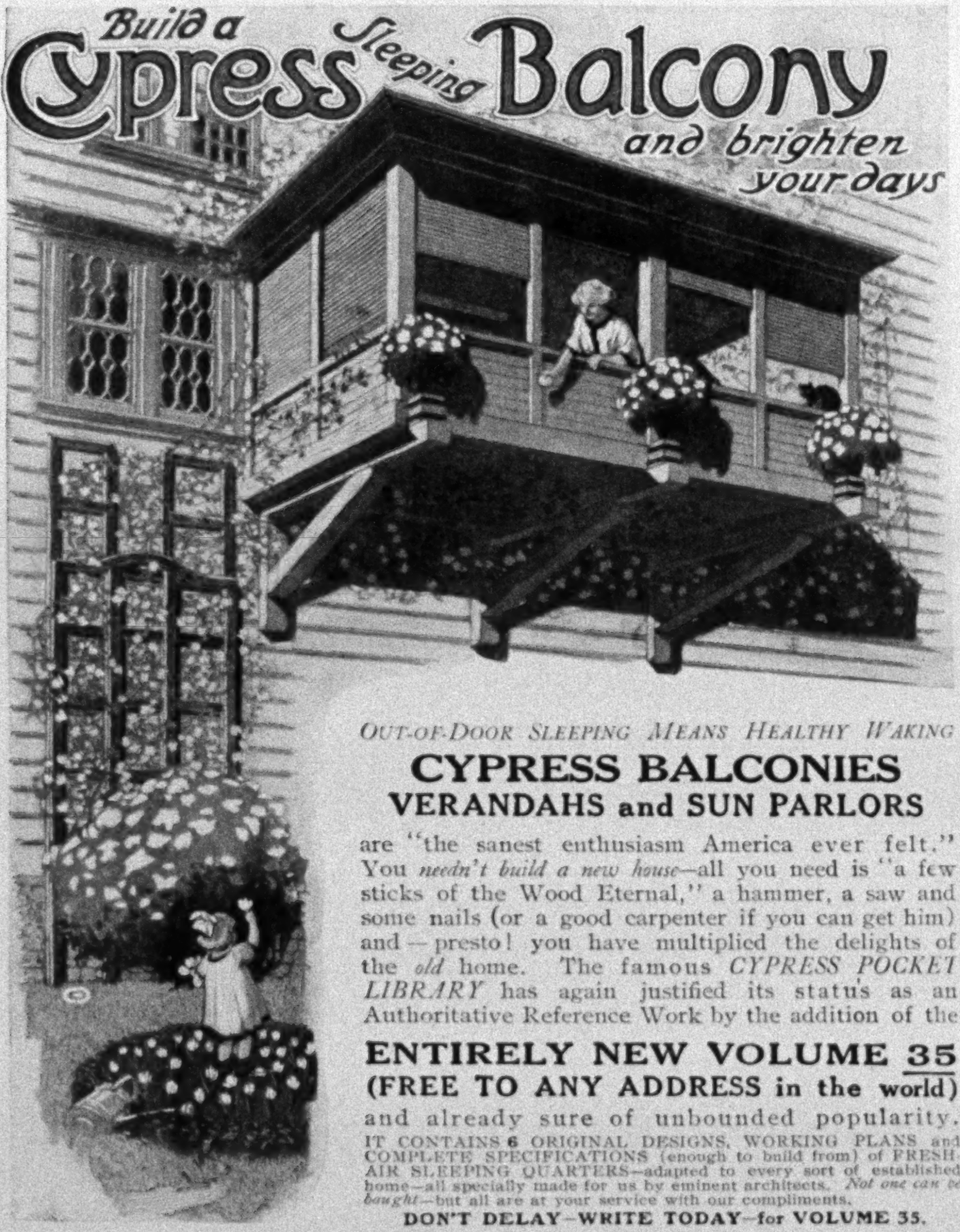

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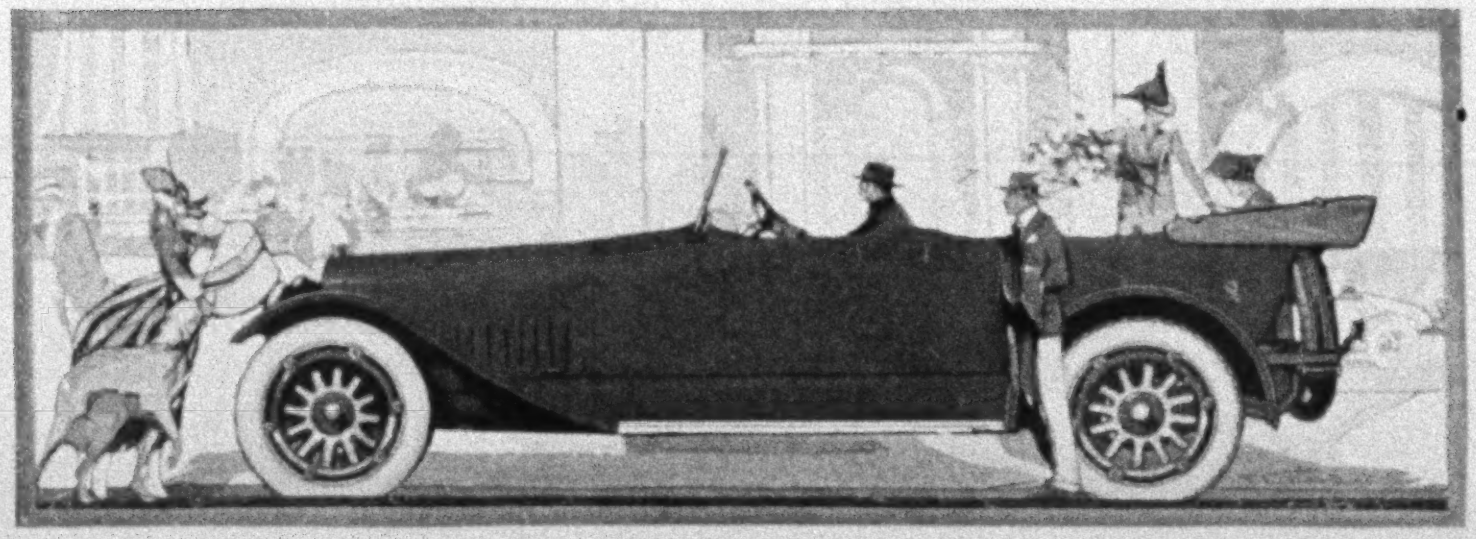

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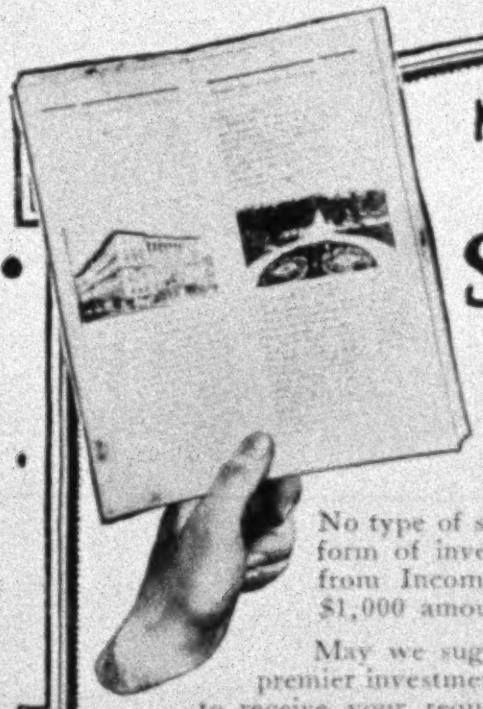

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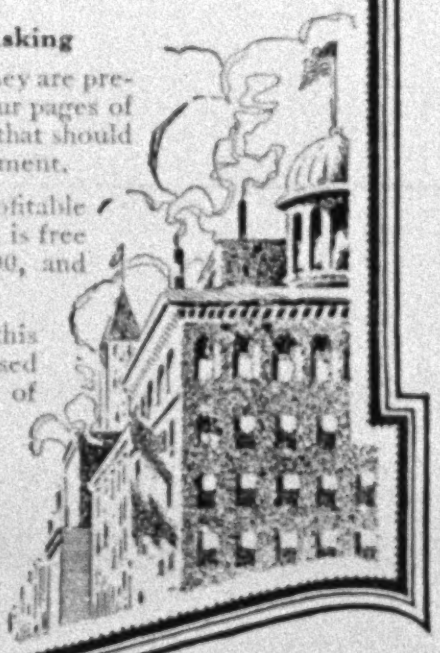

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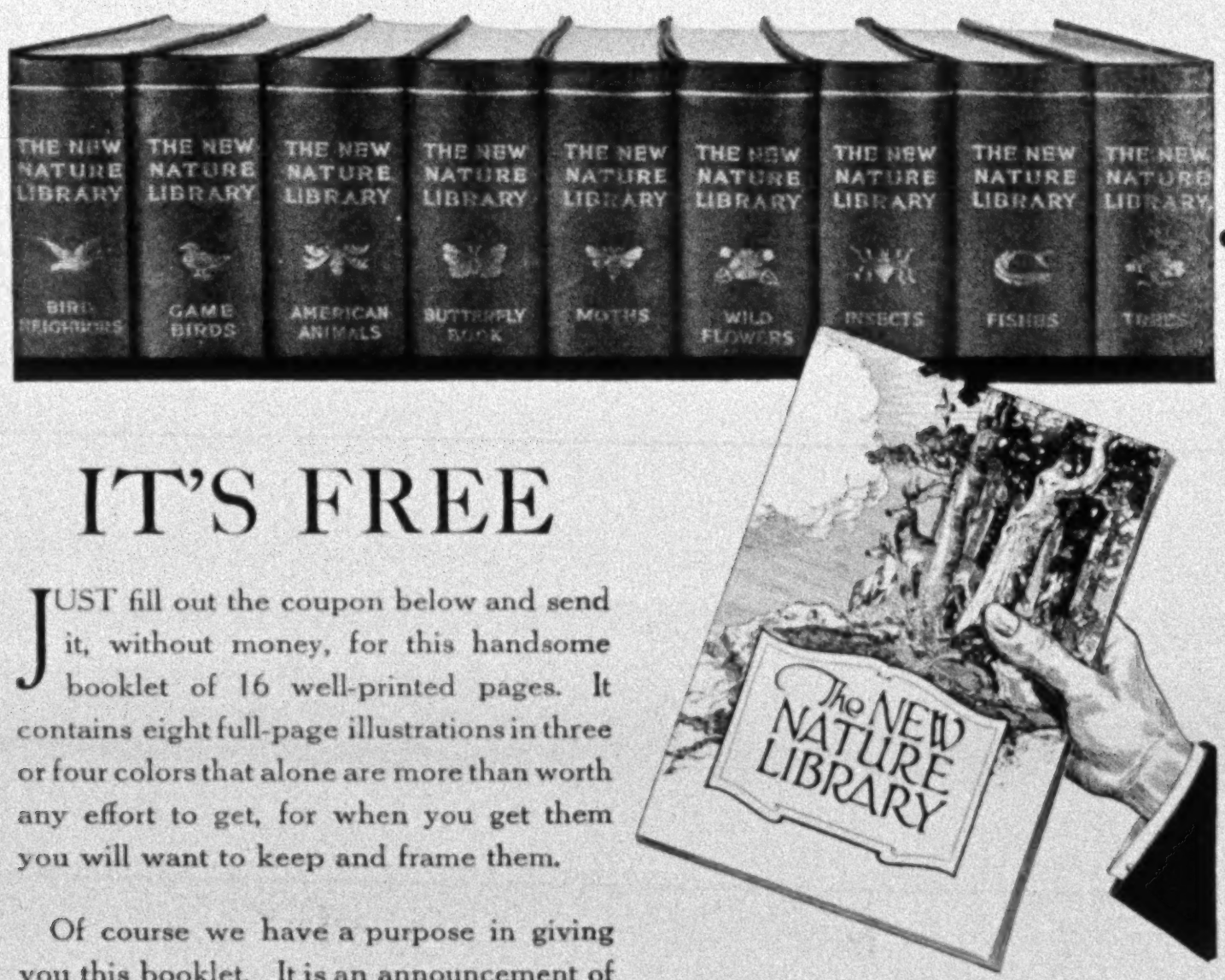

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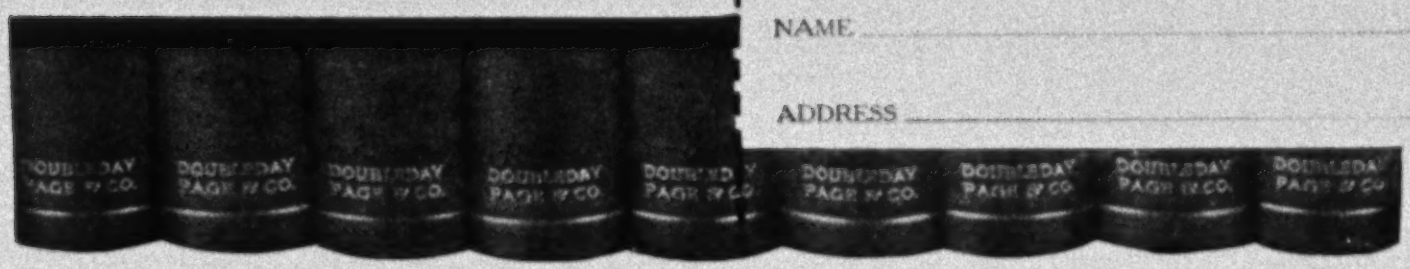

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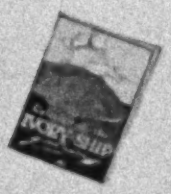

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VOL. XXIX, No. 6 WASHINGTON JUNE, 1916

THE NATIONAL GEOGRAPHIC MAGAZINE

THE WILD BLUEBERRY TAMED

The New Industry of the Pine Barrens of New Jersey

By FREDERICK V. COVILLE

BOTANIST OF THE U. S. DEPARTMENT OF AGRICULTURE

IN AN article published last year describing the successful outcome of experiments in the growing of trailing arbutus from the seed, the incidental statement was made that "in the first trial blueberry plantation, in the pine barrens of New Jersey, blueberries are now produced of the size and color of Concord grapes."* This allusion aroused so much interest among the readers of the NATIONAL GEOGRAPHIC MAGAZINE that the writer has been asked to expand his statement into a description, with illustrations, of the progress that has been made in the new industry of blueberry culture.

Five years ago, in this Magazine, a description was given by the writer of certain physiological peculiarities of the blueberry plant in which it differs fundamentally from the ordinary plants of agriculture.† When given the kind of care, protection, and nourishment usually bestowed on cultivated crops, the blueberry sickens and dies (see picture, page 536).

In a search for the cause of this peculiar behavior it was found that the healthy blueberry plant has on its roots a minute fungus, invisible without the aid of a compound microscope, which, unlike most fungi, appears to be beneficial, not injurious, its particular beneficent action being to furnish nitrogenous food to the blueberry bush. So intimate, indeed, is the relation between the two that the blueberry appears unable to nourish itself properly without the assistance of the fungus.

The problem of blueberry culture, therefore, became primarily the problem of growing the blueberry fungus, and the solution of this second problem lay in the character of the soil. The blueberry fungus requires an acid soil, and it thrives best in one composed of leaf peat and sand. The pine barrens of New Jersey afford just that kind of soil, with every variation in moisture from permanent bog to areas of pronounced aridity.

The failure of earlier experimenters, and there have been several in the last 50 years, to establish an industry of blueberry culture was due primarily to their failure to recognize that an acid soil is the first essential of successful blueberry production.

Before showing what has been done in the way of commercial blueberry culture in the pine barrens of New Jersey, it may be well to contrast an illustration of the

*The Cultivation of the Mayflower. NATIONAL GEOGRAPHIC MAGAZINE, May, 1915.

†Taming the Wild Blueberry. NATIONAL GEOGRAPHIC MAGAZINE, February, 1911.

Photograph from U. S. Department of Agriculture

BLUEBERRY PLANTS, SHOWING THE BENEFICIAL EFFECT OF ACID SOIL AND THE INJURIOUS EFFECT OF RICH GARDEN SOIL

The three large blueberry plants, one year old, were grown in a greenhouse in a peat soil. All three are over twenty-four inches high. Standing on the middle pot is a small glass pot containing a seedling of the same age and origin as the others, but potted in a rich garden soil. The difference in results shows the fundamental importance of a peaty acid soil for blueberry culture.

greenhouse blueberry of 1911 with that of 1916, for the greenhouse and laboratory experiments have been the constant guide of the field plantation (see pages 538 and 539).

While the largest individual berries have been grown in the greenhouses at Washington, the finest clusters and the best formed and most productive bushes have been reared outdoors in the New Jersey plantation. Furthermore, the field plants have reached the stage of commercial bearing at a much earlier age than was expected from observations on the greenhouse plants.

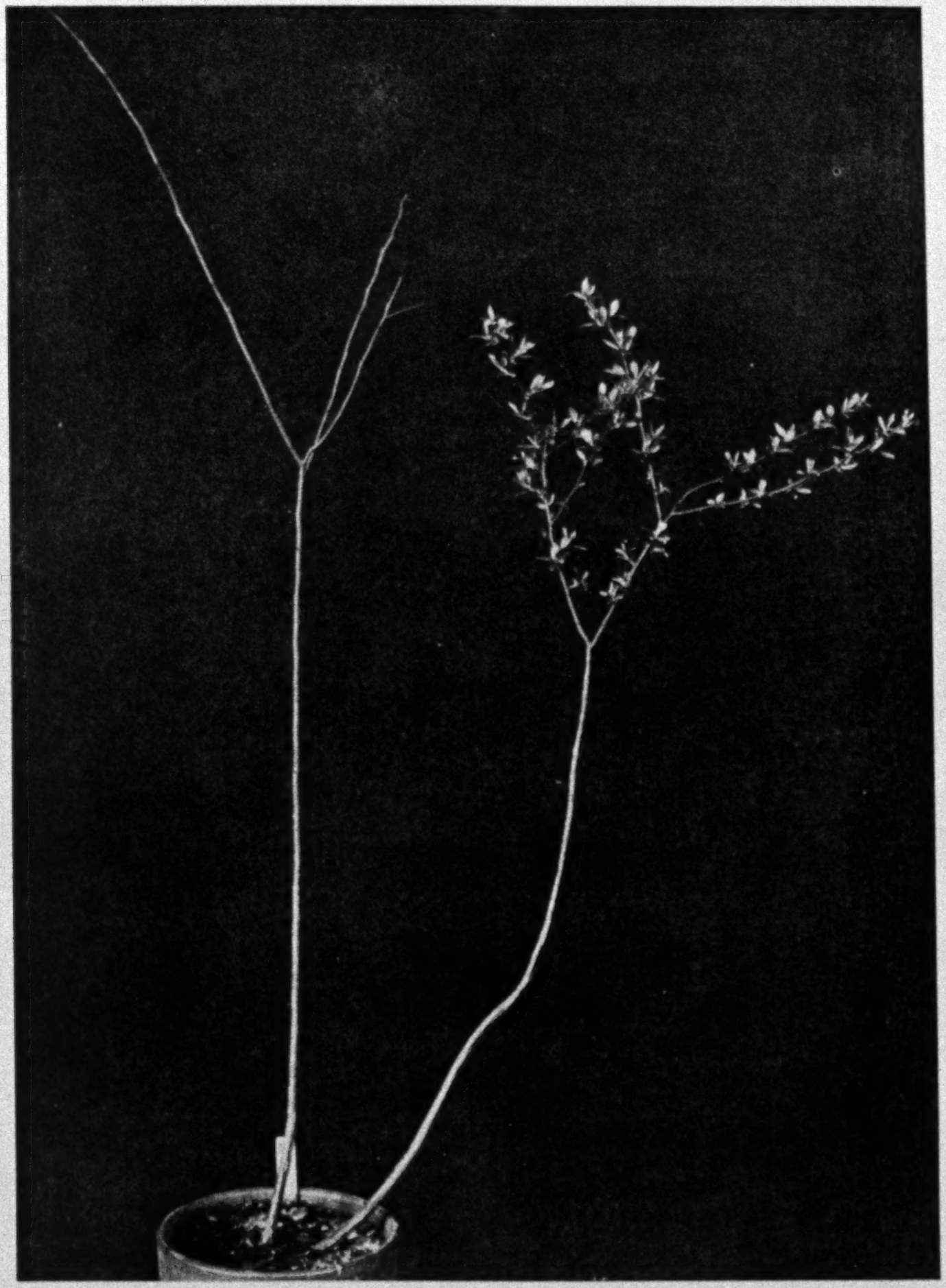
In the article published in 1911 the conservative view was advanced that blueberry seedlings or cuttings would come into profitable bearing, under proper culture, in five to ten years. In the New Jersey plantation hybrid seedlings have borne their first commercial crop when only three years old and a crop three times as large when four years old.

THE BLUEBERRY BUSH LIVES A MAN'S LIFETIME

Under such favorable conditions as exist in the pine barrens, therefore, blueberry culture is to be classed, as to the age of first bearing, not with the slow-fruiting apple orchard, but with the quick-fruiting peach, with this important difference, however, that while the peach tree remains in vigorous fruiting condition for comparatively few years, the blueberry bush, with suitable pruning, bids fair to last a man's lifetime and even longer.

There was once pointed out to me by a man of sixty a handsome, vigorous blueberry bush which he had known from his boyhood and which he said seemed to him just as large and vigorous then as now, and just as highly distinguished among all the blueberries of the region, for it was an albino bush and bore delicious white blueberries for the boys at the swimming-hole in his childhood just as it does today.

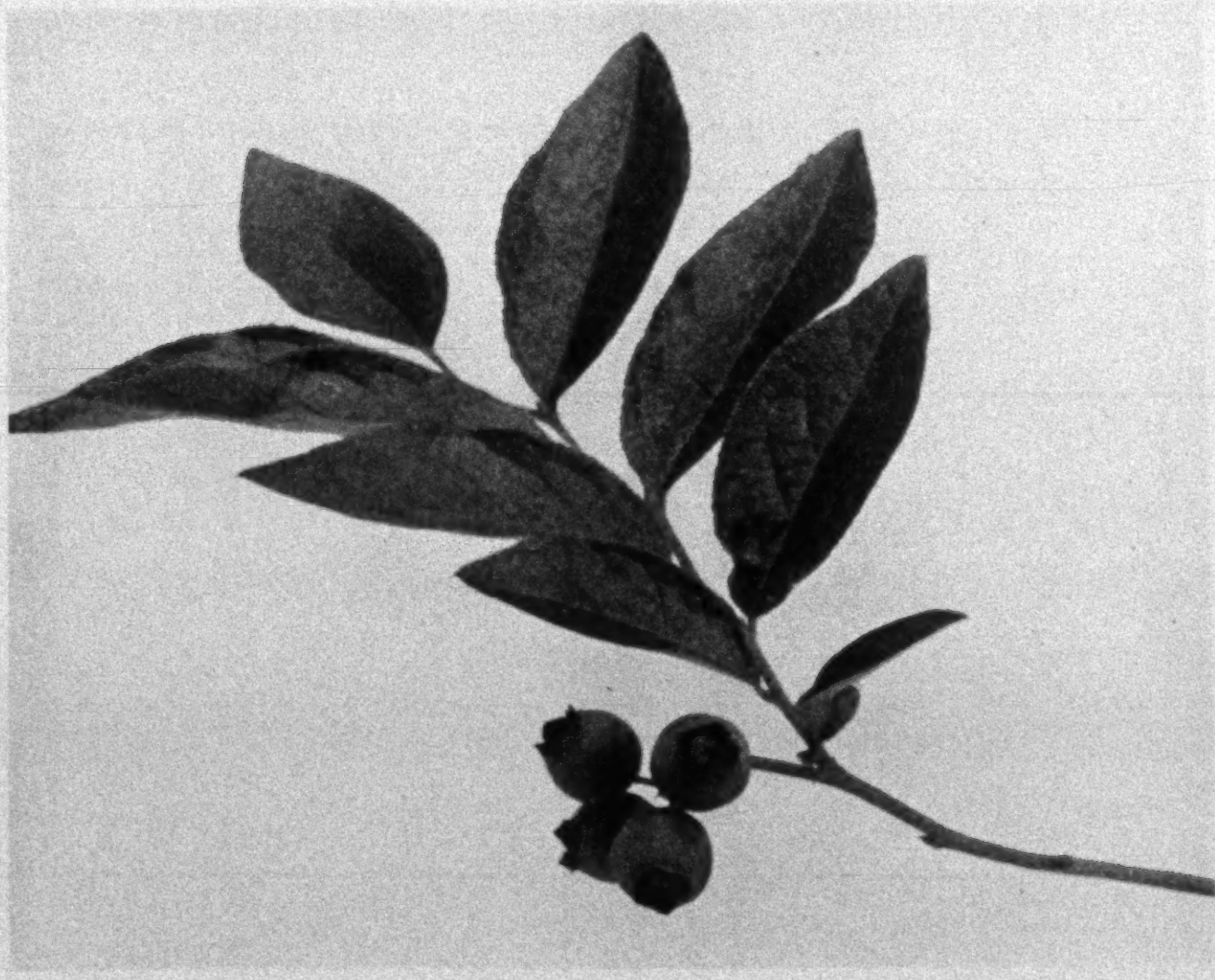
Still further prospects of longevity does the wild blueberry possess. The tall decrepit veteran with densely interwoven and half-dead twigs and feebly moving sap in its old and rheumatic limbs has a means of rejuvenation which nature has not granted to the trees of the old apple orchard. If such an old blueberry bush is burned to the stump, there springs from its ashes a new bush, characterized



Photograph from U. S. Department of Agriculture

BLUEBERRY PLANT, SHOWING THE EFFECT OF COLD IN STIMULATING GROWTH

The stem at the right was kept outdoors, through a hole in the glass side of a greenhouse, exposed to repeated freezing and thawing during the winter months. When spring came this outdoor stem burst into growth, as shown in the illustration; but the stem at the left, which was inside the warm greenhouse all winter, remained completely dormant. A knowledge of this influence of cold in stimulating the growth of the blueberry is of fundamental importance in the propagation of choice blueberries by cuttings.



Photograph from U. S. Department of Agriculture

THE GREENHOUSE BLUEBERRY OF 1911

This illustration was published in the NATIONAL GEOGRAPHIC MAGAZINE for February, 1911, as an example of the fruit of a cultivated blueberry. These berries, reproduced in their natural size, were among the first that were produced on greenhouse plants. The plant itself was a seedling from a large-berried wild bush.

not only by the symmetry and beauty of youth, but by youth's vigor and fruitfulness as well. The wild blueberry is the real and literal phœnix among fruits.

BLUEBERRIES ARE AS DIFFERENT AS INDIVIDUALS

The development of a large-fruited blueberry is very desirable from the standpoint of the grower, for not only is the cost of picking much reduced, but the market price is much increased. One characteristic of the blueberry, however, is of far more importance than size, namely, flavor. When one buys blueberries in the market he gets a mixture of berries from many bushes, and the composite flavor is always good.

It would be a mistake, however, to infer that the blueberries from all wild bushes are of good flavor. They are not. In selecting wild bushes bearing large and handsome berries, to be used as breeding stocks, it has been found that some wild blueberries are sour, others insipid, other rank or even bitter in taste.

All bushes whose berries are devoid of sweetness and the special flavor that characterizes the most delicious blueberries are rejected for breeding purposes, however large or externally beautiful their fruit may be. It is confidently expected that the hybrids produced from such selected parents not only will average better in flavor than the wild berries, but that an occasional hybrid will excel in this respect the best wild berries that we know (see pages 540 to 543).

The improved and cultivated blueberry will be above criticism as to the size of its seeds. All the large-seeded species of this class of berries belong to the true

Photograph from U. S. Department of Agriculture

THE GREENHOUSE BLUEBERRY OF 1916

This cluster contains the largest blueberry produced up to the present time. It measured seven-eighths of an inch in diameter. A bud from the largest-berried plant thus far known was inserted on a very vigorous seedling stock, was forced to rapid and luxuriant growth in the greenhouse, and finally was made to produce these berries. They are shown in their natural size.

huckleberries, and none of these has been used in the breeding experiments.*

PROPAGATED BY CUTTINGS

From the many thousand hybrids testing and to be tested in the New Jersey trial plantation a few bushes bearing the best-flavored, largest, and handsomest berries will be selected for further propagation. Like selected varieties of apples, selected blueberries cannot be propagated successfully from the seed. They do not come true in that way. They do come true, however, when budded or grafted; but, as new shoots are continually springing up below the graft, these methods also cannot be applied satisfactorily to the blueberry.

As early as 1909 it was appreciated that propagation must be effected by cuttings or some similar method, if a particular selected bush was to be perpetuated and increased on a commercial scale. The various methods followed by gardeners in the rooting of cuttings of ordinary plants were faithfully tried, but without success. Thousands of cuttings that started well drooped and died in the cutting beds.

It became evident that new methods

*In the southern United States and in the Middle West blueberries are not ordinarily distinguished from huckleberries, but in New England the distinction is very clearly drawn. The name huckleberry is there restricted to plants of the genus *Gaylussacia*, the berries of which contain 10 large seeds with bony coverings like minute peach pits, which crackle between the teeth. The name blueberry is applied in New England to the various species of the genus *Vaccinium*, in which the seeds, though numerous, are so small that they are not noticeable when the berries are eaten. It is probable that the comparatively low estimation in which this fruit is held in the South is largely due to the lack of a distinctive popular name and the consequent confusion of the delicious small-seeded southern Vacciniums with the coarse large-seeded Gaylussacias. It is the culture of the small-seeded blueberries only, as distinguished from the large-seeded huckleberries, that is here advocated.

Photograph from U. S. Department of Agriculture

THREE-YEAR-OLD BLUEBERRY HYBRID IN COMMERCIAL BEARING

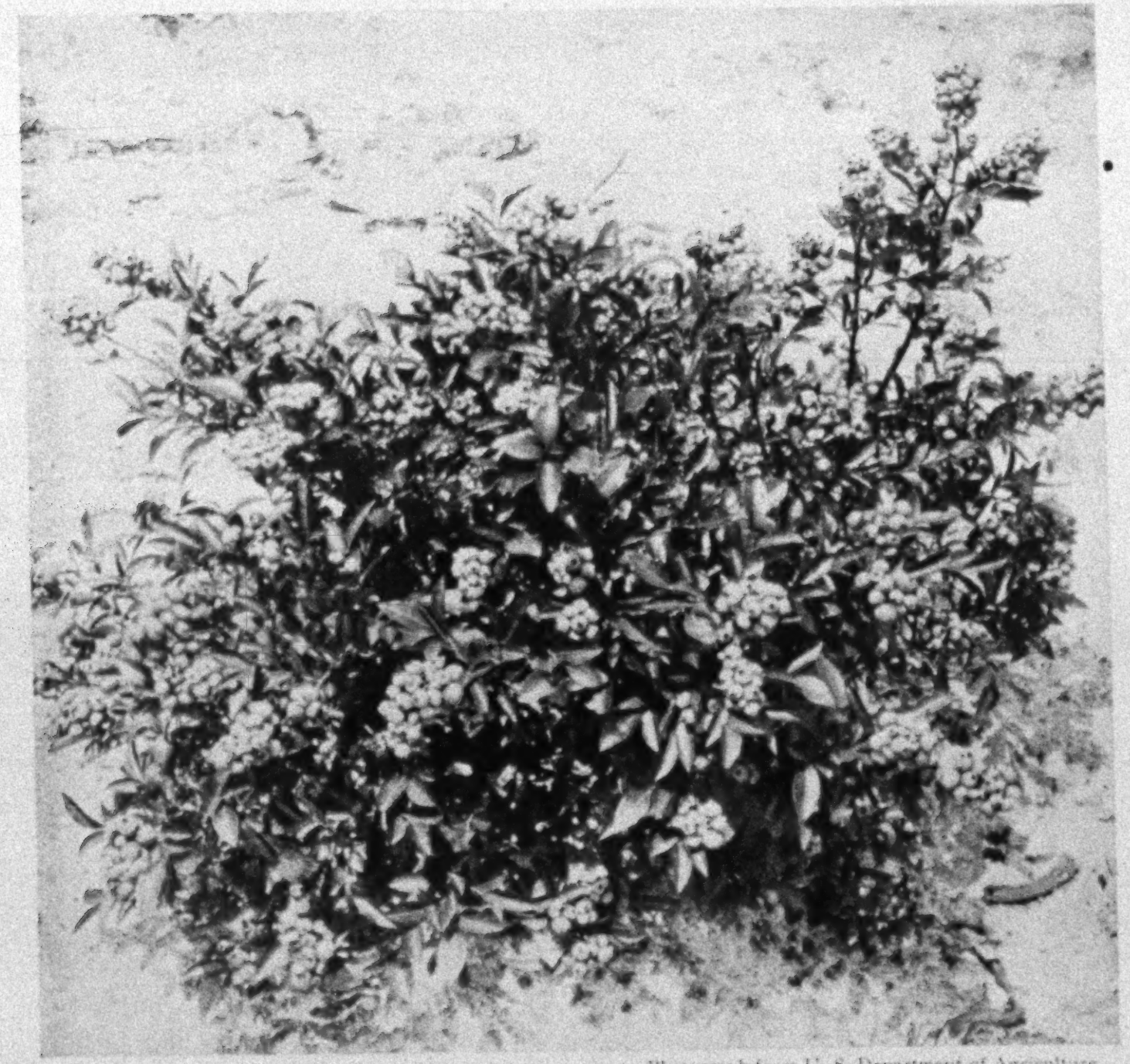
This plant is a hybrid between two selected wild stocks, from Greenfield, New Hampshire, and Brown Mills, New Jersey. They were hybridized in the greenhouses at Washington in the summer of 1912 and the hybrid seeds were sown September 9. The young plants were carried over winter in the greenhouse, and early in September, 1913, they were set out at Whitesbog, in the New Jersey pine barrens. The photograph was taken July 27, 1915, when the plant was a little less than three years old. It is about one-fifth natural size.

must be devised for the rooting of blueberry cuttings, and a detailed study of the subject was therefore begun. For the first few years the varying course of the experiments with cuttings brought a continual alternation of high hopes and severe disappointments.

During those years, however, there began to accumulate from the experiments a definite knowledge of what not to do, and at the same time glints of future success came from occasional cuttings that did develop roots and grow into healthy plants. At last the way became clear, and now cuttings of the choicest plants can be rooted and grown with almost the certainty of seedlings.

THE EFFECT OF COLD

Some of the discoveries made in the course of this investigation are sufficiently curious to be of general interest. One of these is the effect of cold in stimulating the growth of the plant. After



Photograph from U. S. Department of Agriculture

FOUR-YEAR-OLD BLUEBERRY HYBRID

This is one of a series of hybrids made in 1911 between selected wild plants of a low-bush blueberry (*Vaccinium angustifolium*) and a high-bush or swamp blueberry (*Vaccinium corymbosum*), both from Greenfield, New Hampshire. The photograph was taken July 7, 1915, in a field plantation at Whiteshog, New Jersey. The bush bore two quarts of berries and is shown about one-sixth natural size. This lot of hybrids yielded at the rate of twenty bushels of berries per acre at a spacing of three by five feet.

consideration of the puzzling misbehavior of blueberry plants in the greenhouse in winter, the following experiment was tried.

A small opening was made in the glass side of a greenhouse in early January, and through this opening was pushed one of the two stems of a blueberry plant which up to that time had been kept in the warm atmosphere of the greenhouse. The open space about the stem where it passed through the glass was then carefully plugged with moss. During the rest of the winter the plant remained in the same position, the pot and one stem continuing in the warm temperature of the greenhouse, while the other stem, projecting through the glass, was exposed to the rigors of winter, with its alternate freezing and thawing.

When spring came the outdoor stem burst into leaf in the usual manner of a wild blueberry plant, but the stem that had been in the warm greenhouse all win-

Photograph from U. S. Department of Agriculture

A CLUSTER OF OUTDOOR BLUEBERRIES ON A THREE-YEAR-OLD HYBRID

This cluster of berries, which is of natural size, was grown on one of the hybrid bushes in a plantation at Whitesbog (near Brown Mills), in the pine barrens of New Jersey. The berries had a very light blue color, firm but juicy flesh, exceptionally delicious flavor, and seeds so small as not to be noticed when the berries were eaten. The small berries on the cluster were still green. Such berries increase rapidly in size during the few days of ripening.

ter showed neither leaves nor swelling buds. Although perfectly healthy, it remained completely dormant, notwithstanding the fact that it had been surrounded for months by just the conditions of warmth and moisture that ordinarily make blueberry plants grow luxuriantly (see page 537).

The experiment was repeated many times, with various modifications. In some instances the pots were kept outside the greenhouse and one of the stems

Photograph from U. S. Department of Agriculture

PLANTATION OF THREE-YEAR-OLD BLUEBERRY HYBRIDS AT WHITESBOG, NEW JERSEY

These hybrids, photographed in their third year from the seed, were then producing their first commercial crop, seven bushels per acre. The rows are five feet apart and the plants three feet apart in the row, too close a spacing for a permanent plantation (which should be eight by eight feet), but correspondingly more productive in the earlier years.

inside. In other cases the stems were severed from the root, packed in moss or moist sand to prevent drying, and exposed inside or outside the greenhouse.

From these experiments the fact was definitely established that when a blueberry plant has completed its active growth of spring and summer, and later in the season has gorged its twigs, stems, and roots with starch and other storage foods for early spring use, it becomes dormant and, shedding its leaves, refuses to grow again at the temperatures which in spring and summer would be most favorable to its growth.

But after the plant has been exposed to prolonged chilling, at a temperature a little above freezing, it is ready again to grow, and then it is that under the influence of warmth, whether furnished naturally by the sunny days of spring or artificially from the rusty heating pipes of a greenhouse, the buds swell and the plant leaps forward in a riot of rejuvenescence and reproduction.

One change that takes place in the blueberry stems during the period of chilling is the transformation of the stored starch into sugar. The starch must first be turned into sugar before the plant can use it for food, and that change the chilling accomplishes. In the warm

Photograph from U. S. Department of Agriculture

SELF-POLLINATION VERSUS CROSS-POLLINATION

These two twigs, both shown in natural size, were in equally good situations on the same bush, contained the same number of flowers, all pollinated by hand at the same time with equal care, and the fruits were photographed on the same day. The only difference in treatment was that the pollen used on the left-hand twig came from other flowers on the same bush, while the pollen for the right-hand twig was taken from another bush. The cross-pollinated flowers produced a full cluster of handsome berries. The self-pollinated flowers produced no ripe fruit, all the berries that set remaining small and green and later dropping off, until at the time the photograph was taken only two imperfect ones remained. A plantation made up wholly from cuttings from a single bush would produce little or no fruit. At least two original propagation stocks are necessary.

greenhouse there is no accumulation of sugar, the starch remains in storage, and no growth takes place.

THE BUDS ARE PUSHED OPEN BY ENORMOUS INTERNAL PRESSURE

Along with the formation of the sugar, and caused in part by its accumulation, there develop within the minute cells of the plant enormous internal osmotic pressures, which enable the plant to push its buds open.

These pressures are frequently as high as seven atmospheres, or more than 100 pounds to the square inch—a stress that would start a leak in a low-pressure steam-engine. The pressures may become as high as 30 atmospheres, or 450 pounds to the square inch—a force sufficient to blow the cylinder head off of a thousand-horsepower Corliss engine.

The reason that the plant does not explode is because it is broken up into many extremely small and strongly built cells instead of having one big interior cavity. These minute chambers are often as thick-walled proportionally as an artillery shell and, in the case of the starch-storage cells of the blueberry, are clearly of such construction as to be able to withstand enormous pressures.

It turned out that a full understanding of the behavior of blueberry stems when exposed to prolonged chilling was of the utmost importance in the treatment of blueberry cuttings. Limitations of space prohibit the discussion of other phenomena encountered in the experiments. It

Photograph from U. S. Department of Agriculture

A QUART OF SELECTED FIELD-GROWN BLUEBERRIES

This illustration shows, in its natural size, a quart box of selected blueberries grown in the plantation of Miss Elizabeth C. White, at Whitesbog, New Jersey, in a peaty, well-watered, pine-barren soil. There are thousands of acres of such soil in the southeastern quarter of New Jersey now lying unused for any agricultural purpose.

may merely be stated that after each of the essential principles was clearly understood special methods for rooting blueberry cuttings were perfected without serious difficulty and are now in practical operation in the field.

Reference has already been made to the breeding experiments aimed at the production of new and superior varieties of blueberries. In the course of these experiments one fact turned up which merits comment here, because to its curious interest is added its great practical importance in the actual field culture of the blueberry.

An attempt was made to ascertain whether an especially fine blueberry variety could not be made to come true from the seed by pollinating flowers of the individual plant with its own pollen, just as has commonly been done in the breeding of choice varieties of vegetables. From these self-pollinations, however, few berries and seeds were secured.

In all cases, although the pollinations were made very carefully by hand, the

berries that resulted from self-pollination were smaller and later in maturing than cross-pollinated berries on the same bush. On some bushes not a berry matured from many self-pollinations. The same relation exists between the flowers of two plants grown from cuttings of the same bush. These plants behave like different parts of one plant and set little or no fruit from each other's pollen.

From these experiments it became clear that if a blueberry grower should set out a whole field with plants from cuttings of a single choice bush his plantation would be practically fruitless, because it would contain no other blueberry stock from which the bees in their search for nectar could bring the unrelated pollen required to enable his choice plants to set fruit. The best procedure is to make up the plantation with alternating rows of plants propagated by cuttings from two choice varieties. Each will then set fruit in abundance through pollination by the other (see page 544).

The introduction of the blueberry into agriculture has a much more profound significance than the mere addition of one more agricultural industry to those already in existence. Blueberries thrive best in soils so acid as to be considered worthless for ordinary agricultural purposes. Their culture, therefore, not only promises to add to the general welfare through the utilization of land almost valueless otherwise, but it offers a profitable industry to individual landowners in districts in which general agricultural conditions are especially hard and unpromising, and it suggests the possibility of the further utilization of such lands by means of other crops adapted to acid conditions.

AMERICA'S SURPASSING FISHERIES

Their Present Condition and Future Prospects, and How the Federal Government Fosters Them

By Hugh M. Smith

United States Commissioner of Fisheries

THE early history of France, Spain, Portugal, and England in the New World is to a very considerable extent centered in the fisheries. The tales of fabulous quantities of cod, herring, etc., brought back by the European navigators to the western shores of the Atlantic were the principal single inducement or incitement to further voyages of adventure and discovery; and the verification of these tales was a potent factor in subsequent colonization.

A cod fishery about Newfoundland was conducted by Normans and Bretons as early as 1504, and there is a tradition among the fishermen of the Bay of Biscay that one of their number who had been fishing in the western Atlantic informed Columbus of the existence of land in that region before the illustrious explorer had begun his memorable voyages.

A very able American writer on the early fisheries of the country makes a plausible case in favor of his contention that the Pilgrims could not have escaped the fishing mania which affected all other people of maritime Europe at the time, and that these weary exiles in Holland, noting the riches acquired by the Dutch from their fisheries, could not have been unmoved by the accounts of the vast shoals of fish to be found on the shores of the New World.

The settlement of Massachusetts colony was due directly to the fisheries, and the original proprietors of New Hampshire went there for the sole purpose of

acquiring wealth by fishing and trading. The first articles exported from New England were fish, and the commerce and navigation of that section were founded on fish. Most of the conflicts between the English and French colonies, which continued for 150 years and terminated on the Plains of Abraham, grew out of or involved disputes over the fisheries.

With the extension of our country, new aquatic wealth was found and utilized, contributing materially to early development and subsequent prosperity; particularly noteworthy were the oyster beds and river fishes of the Middle and South Atlantic States, the whitefish and other food fishes of the Great Lakes, and the salmons of the Pacific States.

With the acquisition of Alaska there came to us marine resources of such transcendent value as to overshadow all other natural products and to give the United States fisheries the leading place among the nations.

The creatures which support our fisheries are not all fish, but belong in various classes, some of those contributing most notably to the importance of the industry being crustaceans and mollusks. In a total annual value at the present time of approximately $76,000,000, the relative and actual importance of the different groups is shown in the accompanying diagram.

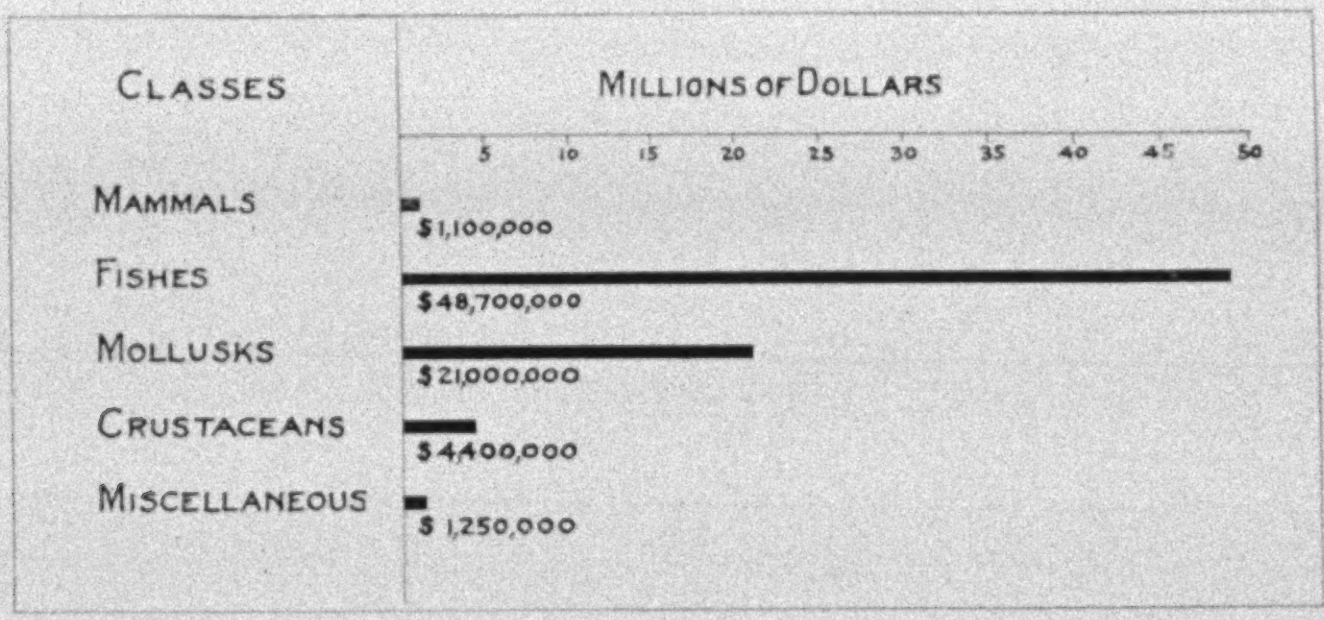


ILLUSTRATION OF THE ANNUAL VALUE OF AMERICA'S FISHERIES

The oyster industry accounts for the principal value of the mollusk fisheries, while the lobsters and crabs constitute the principal part of the crustacean catch. Seals and whales contribute the bulk of the returns of the mammal fisheries.

THE VANISHING WHALES

Most prominent among the aquatic mammals are various kinds of whales and the Alaskan fur seal. At the outbreak of the American Revolution and for a period of 75 years following the conclusion of that struggle, whaling was the most important branch of the American fisheries. From 500 to 700 vessels sought whales in all the oceans and seas of the world, and in one year New Bedford alone sent out 300 vessels, whose cargoes of bone and oil were the basis of the industrial life of the city.

The pursuit of sperm whales reached its climax in 1837, when oil valued at nearly four and a half million dollars was brought in, mostly from the South Pacific. The height of the industry was in 1846, when 70,000 persons derived their support from whales, and 720 vessels, valued at $21,000,000, were engaged.

For more than fifty years the fishery has been declining, and in numerous ports that once derived most of their wealth from the industry there have for a long time existed only memories of former greatness. For a number of years the

Photograph and copyright by Asahel Curtis

INDIANS STRIPPING THEIR PREY AT NEAH BAY: WASHINGTON

Whenever the coastal Indians kill a whale, they have a feast, literally gorging themselves with the flesh, blubber, and other parts

sperm, right, and bow-head whales that supported the fishery in early years have been very scarce and their pursuit has been unprofitable; and the present importance of the whale fishery, amounting in value to less than 2 per cent of the American fisheries, depends on the taking from shore stations of species of whales that formerly were for the most part neglected.

The glory of the whale fishery has departed forever; and the commercial, if not the biological, extinction of all kinds of whales is proceeding rapidly, undeterred and unlamented by the principal maritime powers.

THE ALASKAN SEAL HERD RESTORED

The Bureau of Fisheries is the official custodian of the most valuable herd of animals that any government of the world possesses. This is the herd of fur seals which roam over the eastern side of the north Pacific Ocean and return for breeding purposes to the Pribilof* Islands. After being sadly decimated by indiscriminate slaughter at sea, the herd has been rapidly recuperating under the influence of an international agreement, and soon the fur seals may be as numerous as when they came into the possession of the United States Government with the purchase of Alaska.

The fact that the only land to which these animals ever resort is two islets in Bering Sea belonging to the United States gives our government a claim to possession such as is exercised over no other wild creatures of water, land, or air. This governmental ownership or jurisdiction is the only reason why the fur seal has not long ago succumbed to the fate that is rapidly overtaking all the other large marine animals.

In the summer of 1916 more than 100,000 young seals will have been added to the Alaskan seal herd, whose total strength will then be upward of 400,000 individuals of all classes. For some years only a limited number of seals have been utilized for the food purposes of the natives; but after the present close-time law expires, in 1917, there will be available for commercial use many young male seals, which add nothing to the reproductive capacity of the herd and may properly be utilized for their skins and other products.

In fact, the seal herd may be managed after the manner of a herd of cattle or sheep, and if handled in a strictly scientific way will add to the Federal treasury a very handsome revenue, which will increase yearly as long as the existing international arrangement continues.

Meanwhile a revolution will have occurred in the world's fur-seal trade, for the Department of Commerce has changed the old order of things, and, for the first time, this American product, belonging to the American public and most largely used by American women, will be sold in an American market, instead of being sent abroad for sale; and the peculiar dressing and dyeing process, which is necessary to bring out the beautiful qualities of the Alaskan sealskin, will likewise have been brought from abroad and established in America.

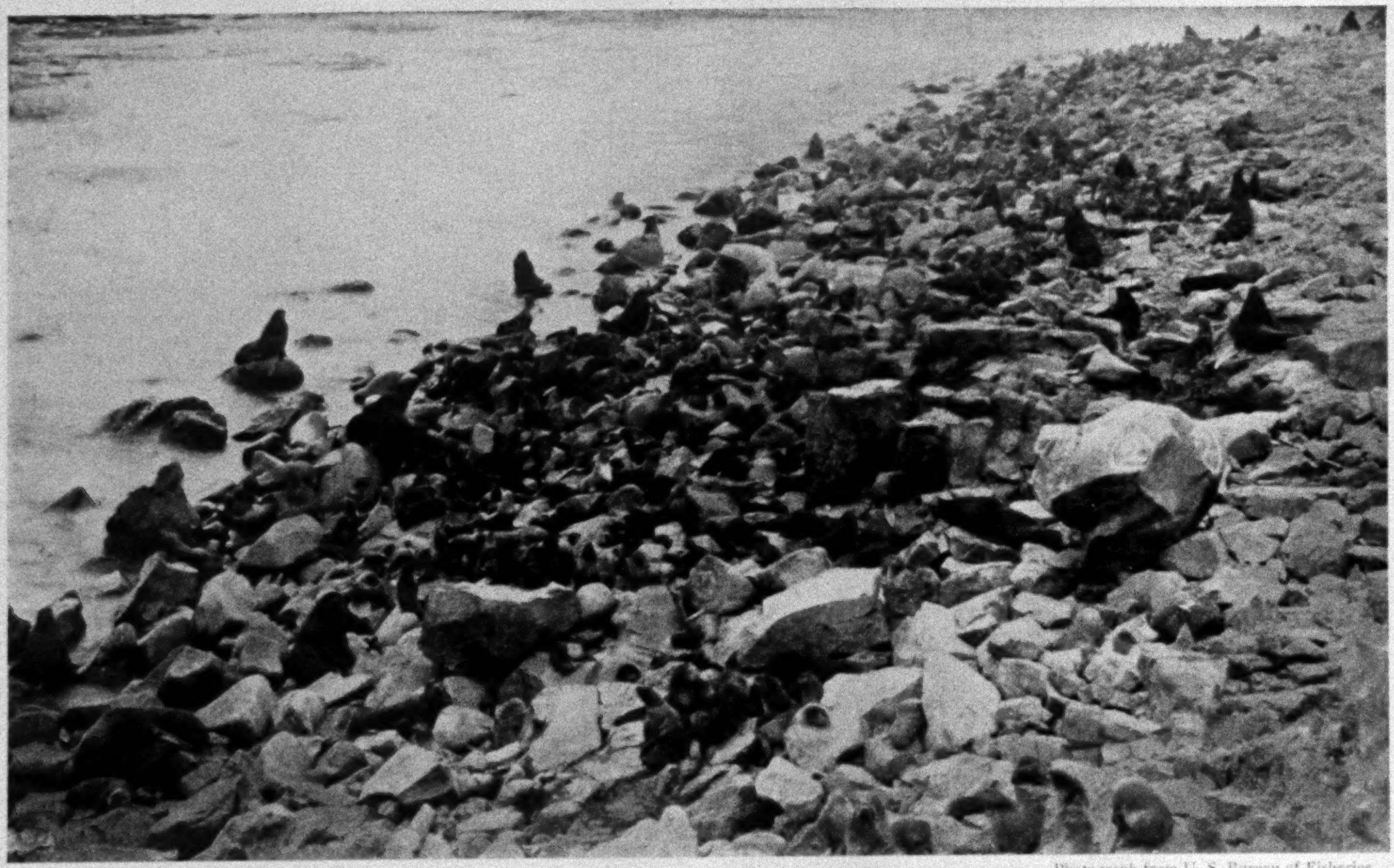
THE ASTONISHING FISH LIFE OF OUR COASTAL AND INTERIOR WATERS

To give a mere list of the American fresh-water and salt-water fishes which support important industries would require several printed pages, for there are few, if any, countries that can boast of a larger variety of highly valuable fishes.

Every person familiar with the north Atlantic coast will recall the prominent place occupied by the cod, haddock, hake, pollock, halibut, mackerel, bluefish, herring, squeteague, sea-bass, scup, and swordfish, all of which are staple foods. On the south Atlantic seaboard the major food fishes are the mullet, croaker, spot, Spanish mackerel, in addition to the bluefish and squeteague. In the Gulf of Mexico the mullet and red snapper hold front rank among a host of excellent species. The Pacific coast supports a great profusion of flounders and rockfishes, and, to the northward, cod, halibut, and herring in extraordinary abundance.

The migratory fishes of our seaboard streams are not equaled in abundance,

* See "Making the Fur Seal Abundant," by Hugh M. Smith, in the NATIONAL GEOGRAPHIC MAGAZINE for December, 1911.



Photograph from U. S. Bureau of Fisheries

A HERD OF ALASKAN FUR-SEAL

After being sadly disseminated by indiscriminate slaughter at sea, the herd has been rapidly recuperating under the influence of an international agreement, and soon the fur-seals may be as numerous as when they came into the possession of the United States Government with the purchase of Alaska (see text, page 549).

variety, and excellence anywhere else in the world. They include the shad, alewives, smelt, striped bass, and perches of the Atlantic slope, and the salmons of the Pacific. The latter have been supplemented by the shad and striped bass, introduced from the east and now among the most abundant of the river fishes of the Pacific States.

Among the important strictly freshwater fishes, first place must be given to the trout, whitefish, herrings, and pike perch of the Great Lakes, and to the basses, catfishes, buffalo-fishes, suckers, and carp of the interior waters generally. The last-named fish, introduced into Europe from Asia some centuries ago and brought to America from Europe about 1876, has become the most widely distributed, most abundant, and most important single fish of the fresh waters of America.

MOST ABUNDANT ECONOMIC FISH OF ATLANTIC SEABOARD

The most numerous fish of economic importance on the east coast of the United States is the menhaden, which is known also by a large number of other names, some of them inappropriate and misleading. It is a member of the herring family; goes in great schools in the ocean, bays, and sounds, and supports a fishery from Maine to Florida.

Although the menhaden is a palatable food fish, its principal value now, as in the past, is for conversion into oil and fertilizer. At times it is exceedingly fat, and yields a cheap grade of oil much used in the industries, while the part remaining after the extraction of the oil is rich in ammonia and is one of the best fertilizers, whether employed alone or in combination with other ingredients.

The great abundance of the menhaden, its wide distribution on our coast, and its peculiar properties led many years ago to the establishment of an industry which soon became, and continues to be, one of the leading branches of the fisheries. In addition to the major uses referred to, large quantities are utilized as bait in the line fisheries for cod, mackerel, bluefish, and other fishes, and insignificant numbers are used as human food.

The chief purpose, however, which the menhaden serves is as food for numerous valuable fishes along the entire coast. It forms at times the principal diet of bluefish, swordfish, squeteague, bonito, mackerel, Spanish mackerel, etc., and often when we eat these fishes we are really consuming transformed menhaden. The abundance or scarcity of menhaden in a given season or on a given part of the coast may determine the abundance or scarcity of various important food fishes; and for this reason, in addition to its immediate value to man, it has by some persons been regarded as the most important fish on the Atlantic coast of the United States.

For many years the menhaden fishery has been the subject of much discussion and local opposition. In the opinion of many people, the catching of enormous numbers each year by means of purse seines has a tendency to make scarce the fishes which prey on the menhaden, and thus injury is done to other fisheries, particularly those carried on with lines by professional fishermen and sportsmen.

It is impossible to discuss this important question properly within reasonable space limits, and it will suffice to state that while the quantities of menhaden caught by man are insignificant by comparison with those consumed by other animals; while it may be unsafe to ascribe the scarcity of any food fish in a given year or locality to the effects of the menhaden fishery, inasmuch as some of our most important fishes are known to have exhibited periods of scarcity before the menhaden fishery was inaugurated, and while it is improbable that the operations of the fishermen have had any permanent influence on the abundance of the menhaden, nevertheless there is reason to believe that the presence of desirable food fishes in certain waters may be materially affected by the capture therein of large quantities of menhaden, and the fishery for the latter species should therefore be subject to Federal or State legislation.

Some idea of the abundance of menhaden and the magnitude of the fishery may be gathered from the fact that in 1913, when the Bureau of Fisheries made a special investigation and a statistical

GOVERNMENT SPAWN-TAKERS AMONG THE GLOUCESTER, MASSACHUSETTS, COD FISHERMEN

A very trying life, full of danger and exposure. At the Gloucester hatchery many hundred million eggs of cod and other valuable commercial food fishes are taken every year from fish that have been caught for market and whose eggs would be entirely lost except for the operations of the Bureau of Fisheries.

canvass of the industry, more than one billion fish were caught and converted into over six and a half million gallons of oil and nearly ninety thousand tons of fertilizer, valued at three and a half million dollars. These fish, if placed end to end, would have extended in an unbroken line six times around the earth at the Equator, and their weight exceeded that of all the inhabitants of Greater New York.

OUR UNSURPASSED SHELL-FISHES

There is no stretch of coast along the many thousand miles of shoreline of our mainland and islands, from Passamaquoddy Bay to the Rio Grande and from the Mexican boundary to the Gulf of Georgia, including all bays, sounds, and estuaries, that does not support some form of valuable crustacean or mollusk. Among the most prominent are the lobster of the North Atlantic coast, the spiny lobsters of Florida and California, the small blue crab of the Middle and South Atlantic and Gulf waters, the great crabs of the Pacific States and the shrimp and prawn of the Gulf of Mexico and California.

By far the most valuable of these is the lobster, which supports a fishery from Maine to Delaware and is the principal means of livelihood in many New England communities. For many years the fishery has presented the striking anomaly of an annually declining output and an annually increasing income to the fisherman. In the past quarter of a century the catch has decreased over 60 per cent, while the receipts of the fishermen have increased 200 per cent. The lobster, which because of its nutritious character

A GOVERNMENT SPAWN-GATHERER AT WORK ON A GLOUCESTER FISHING SMACK

While most of the spawn used in government cod propagation comes from fish kept for breeding purposes, this has to be supplemented by that gathered from fish caught by the commercial fishermen.

should be a staple food, has for years been a luxury, and every season the price to the retail consumer becomes more prohibitive.

The reasons for the diminishing supply are well known and may be summed up in a few words: disregard for the future, neglect of natural laws, and indiscriminate fishing. The situation demands radical action on the part of the States, and the welfare of the general public must be placed ahead of the temporary gain of fishermen.

The mollusks which figure most prominently in the fisheries and enter most largely into our dietary are the hard-shell clam, or quahog, known as the "little neck" when young; the soft-shell clam, or maninose, extensively used as bait in the New England line fisheries, in addition to being a highly prized food; the small and the giant scallops; the sea-mussel; the abalone, peculiar to the Pacific coast and more valuable for its brilliantly colored nacre than as an article of diet for occidentals; the squids, eaten by Asiatics and by the people of southern Europe, but used mostly for bait in line fishing, and, most important of all, the oysters of the eastern and western seaboards.

Throughout a vast area in the interior of the country there occur numerous species of mussels, or fresh-water clams, which have no utility as food, but because of their pearly nacre are in great demand for their shells. A very extensive industry, of comparatively recent origin in the United States, is based on the utilization of these shells for making buttons (see p. 563). These same mussels produce the only valuable pearls found in our waters.

Photograph from U. S. Bureau of Fisheries

SAVING THE NEW ENGLAND LOBSTER FISHERY

These men are bringing egg-bearing lobsters to the hatchery at Boothbay Harbor, Maine. The Bureau of Fisheries, in coöperation with the State authorities, collects egg-bearing lobsters from the fishermen, takes the lobsters to the hatcheries, and saves all the eggs, which would otherwise be lost. The mother lobster carries her eggs externally for ten months, and if caught at any time during that period her entire progeny is sacrificed unless her eggs are safeguarded by the lobster culturist. The lobster's eggs are about one-eighth of an inch in diameter and from 10,000 to 15,000 are produced by an average lobster.

A LOAD OF EGG-BEARING LOBSTERS

These lobsters have been collected from the fishermen and are being taken to the hatchery, where their eggs will be removed by gentle scraping with a dull knife

AMERICA PREËMINENT IN OYSTER PRODUCTION*

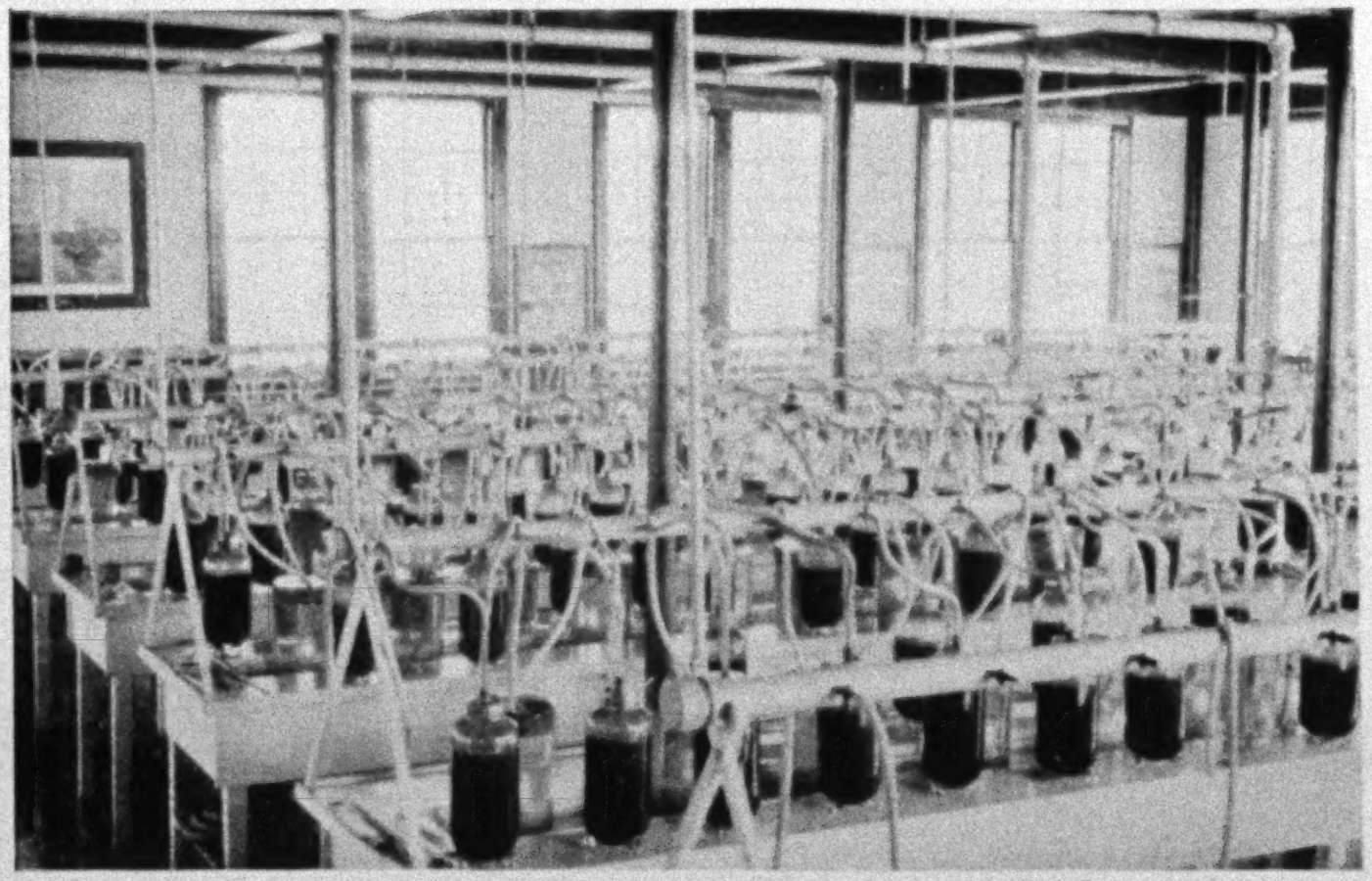
Among the fishery products in which America is preëminent, the most conspicuous is the oyster. This, our most important aquatic resource, is not only more valuable than in any other country, but more valuable than in all other countries combined.

The American oyster has the further distinction of being a staple food of comparatively low price, while in practically every other country having a well-developed oyster industry the oyster is a high-priced luxury. Its commanding position is shown in the facts that it is a commercial commodity in every coastwise State except two (Maine and New Hampshire); that it is the leading fishery product in fifteen States, and that it is the most extensively cultivated of all our aquatic animals. The annual oyster crop of the United States is about 35,000,000 bushels.

The yield is increasing yearly, and in some States is capable of great expansion, while in a few States the limit of production has nearly been reached. The seven leading oyster States are Rhode Island, Connecticut, New York, New Jersey, Maryland, Virginia, and Louisiana. Virginia and Maryland have the largest output, while New York and Connecticut have the largest money returns. The body of water which produces more oysters than any other in the United States, or, in fact, the world, is Chesapeake Bay. Other important regions are Narragansett Bay, Long Island Sound, New York Bay, and Delaware Bay.

The early rank taken by our oysters,

* See "Oysters—the World's Most Valuable Water Crop," by Hugh M. Smith, NATIONAL GEOGRAPHIC MAGAZINE, March, 1913.



Photograph from U. S. Bureau of Fisheries

TWO HUNDRED MILLION LOBSTER EGGS INCUBATING IN THE AUTOMATIC HATCHING JARS AT A NEW ENGLAND LOBSTER STATION OF THE U. S. BUREAU OF FISHERIES

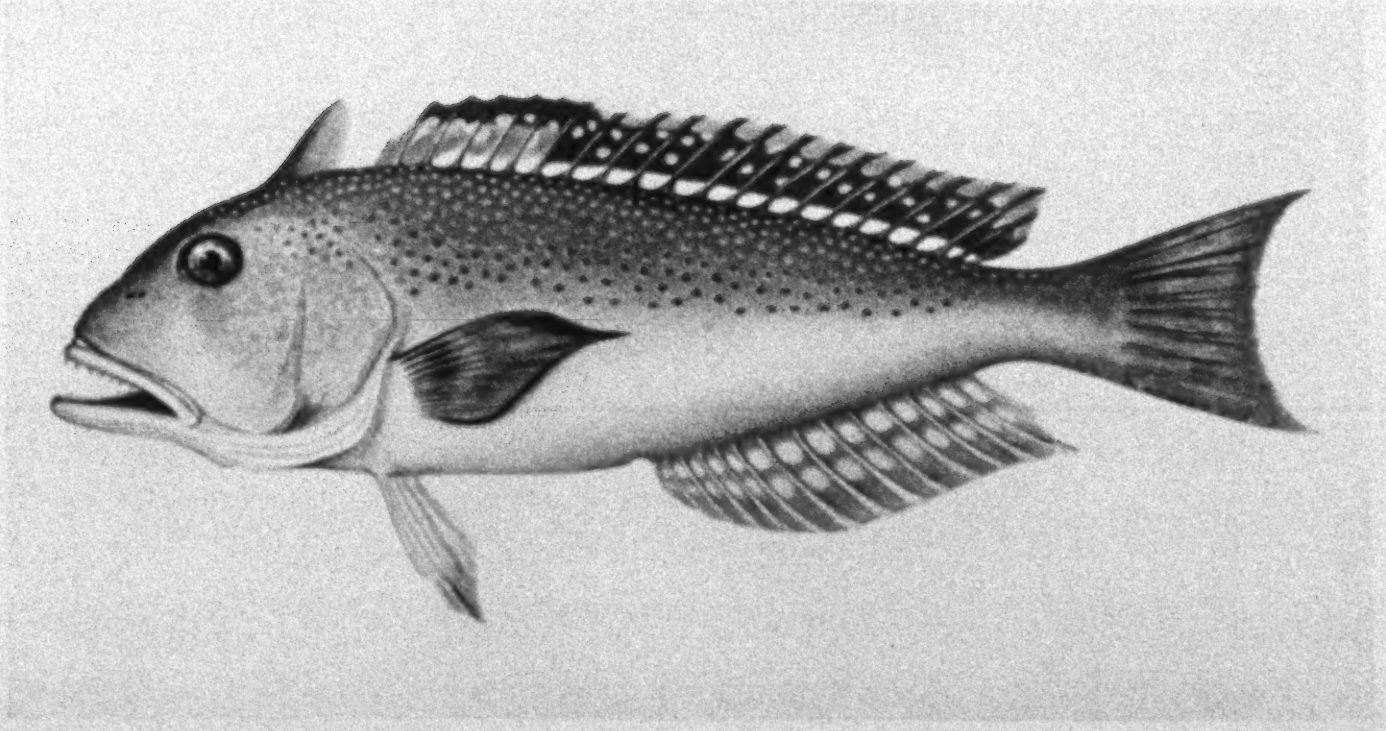
aside from their excellent flavor and large size, was due chiefly to the vast area of the oyster beds. The maintenance of that rank, however, has depended on oyster culture. Whenever the oyster fishery has been active, the necessity for artificial measures to maintain the supply has sooner or later become obvious, and at present about half a million acres of bottoms covered by salt or brackish water are being cultivated as oyster farms.

Although about 50 per cent of the quantity and 70 per cent of the value of our annual oyster crop are derived from planted grounds, and such product is larger than in all the remainder of the world, it is a significant fact that in no other important oyster-producing country is so large a proportion of the oyster output derived from natural beds.

Some of the States have only slowly appreciated the advantages that accrue from oyster farming and have been loath to abandon principles of oyster management that long since became obsolete. The welfare of their oyster industry has thus been greatly impaired, while more progressive States have reaped large benefits from the general adoption and encouragement of private oyster planting instead of continuing to depend on the diminishing output of depleted natural beds.

Oyster culture as practiced in America consists essentially of the following features; (1) Acquiring from the State, by lease or purchase, suitable submerged bottom; (2) cleaning and otherwise preparing that bottom, if necessary, for the growth of oysters; (3) sowing thereon oyster shells or other similar material, technically known as "cultch," for the attachment of the young oysters; (4) insuring the set of "spat," or larval oysters, by having adult oysters on contiguous bottom; (5) protecting the beds from starfishes, drills, and other natural enemies; (6) transplanting the oysters to prevent overcrowding and to facilitate growth and fattening, and (7) culling and sorting for market.

The United States Government, through the Bureau of Fisheries, while exercising



THE "TILEFISH," LATELY INTRODUCED TO THE AMERICAN DINNER TABLE

The tilefish first came to the attention of science in 1879. Three years later the Gulf Stream, with its warm water, drifted off of the continental shelf in tilefish territory, with the result that perhaps a billion and a half members of the species died, literal victims of a cold wave (see text, page 570).

no jurisdiction over the oyster grounds, has done much to promote the industry. The assistance rendered has taken various forms and has included studies of the oyster's life history, on the accurate knowledge of which protection and cultivation must depend; surveys of grounds on which oyster planting may be conducted, thus increasing the output and at the same time affording a larger revenue to the States from the sale or lease of such grounds to prospective farmers; experimental and model planting operations, often in regions where no oyster culture was previously conducted; recommendations for oyster legislation, and disinterested expert advice on the various problems that arise in the administration and practical conduct of the oyster industry.

ALASKA'S ENORMOUS FISHERY WEALTH

The salmon resources of the Pacific States are among the natural wonders of the Western Hemisphere, but they now take rank after those of Alaska, whose fisheries as a whole have experienced their remarkable development and attained their present surpassing importance chiefly because of the salmons.

Since Alaska became a part of the national domain, the total value of the products taken from the waters of the territory up to the present year has been nearly $300,000,000; the fishery reached its climax in 1915, with a value of $21,000,000, which is three times the purchase price of Alaska. Included in the foregoing aggregate are the very considerable sums accruing from the fur seal; but the bulk of the output represents the salmons, with cod, halibut, and herring completing the list of important fishes.

The halibut fishery of Alaska is far more productive than the halibut fishery of the Atlantic coast ever was, even in its palmy days; and it, with the fisheries for cod and herring, is capable of much further development.

The weight of the salmons taken in Alaska in 1915 was about 400,000,000 pounds. If this catch could have been placed in barrels holding 200 pounds each and the barrels piled end on end, the height of the column would have been about 1,200 miles! Or if the catch had been loaded into ordinary freight cars, a train of 10,000 cars would have been required and the length of the train would have exceeded 100 miles!

Photograph and copyright by Detroit Publishing Co.

A FLAKE YARD: GLOUCESTER, MASSACHUSETTS

Salted cod and other ocean fishes are fully cured by drying in the open air, and are then converted into "boneless" fish in numerous establishments on the water front of this old town

PLANTING THE WATERS

To compensate for the vast quantities of food fish taken annually from the coastal and interior waters of the country, the Federal Government conducts very extensive operations in artificial propagation, coöperating with the various States which are engaged in similar work or acting alone in the many States which have no hatcheries of their own. The States which maintain fish hatcheries number about twenty.

The year ending on June 30, 1916, was the most successful in the history of government fish culture in America. About five billion food and game fishes were brought into being under Federal auspices and distributed where they would do the most good. So comprehensive and well organized has this work become that the egg-collecting and hatching operations were conducted in 32 States and Alaska, and the output reached the waters of every State and Alaska.

The major fish-cultural efforts are directed to the cod, haddock, pollock, flounder, and lobster of the New England coast; to the salmon, shad, striped bass, white perch, and yellow perch of the streams of the Atlantic seaboard; to the whitefish, trout, and pike perch of the Great Lakes; to the salmons of the Pacific streams, and to the numerous trouts, basses, and other food and game species of the interior waters.

Distributions in public waters are made on the initiative of the government or on the recommendation of the State authorities; but the fishes adapted for ponds, smaller lakes, and minor streams are for the most part consigned on individual applications and are supplied without cost.

In moving the hatchery output to the points of deposit, specially constructed railway cars, with expert crews, are required, and in 1915 about 640,000 miles of railway travel by cars and detached messengers was needed for the distribution.

The fish-cultural work is so popular throughout the country, and the demand for fish for stocking public and private waters is so great, that new hatcheries are established by Congress from time to time, and a bill recently reported favorably to the House of Representatives provides for eighteen additional hatcheries to enable the Bureau of Fisheries to increase its operations in old fields and to extend its activities into new territory.

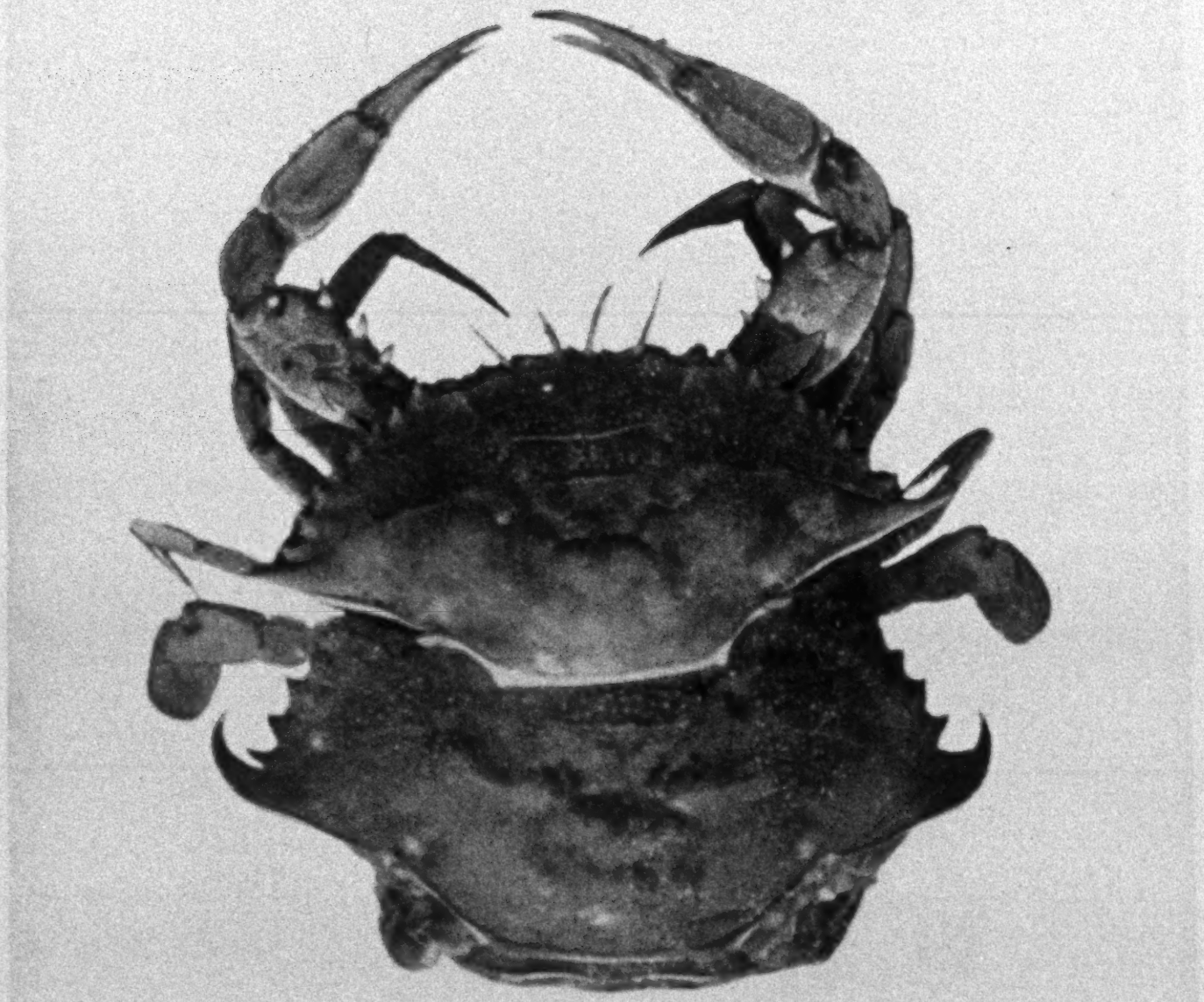
RESCUE OF FISHES FROM OVERFLOWED LANDS

An important adjunct and outgrowth of the hatchery operations is the rescue of fishes from the flooded lands in the valleys of the Mississippi and some of its tributaries. When these rivers overflow their banks and extend into the adjacent cultivated and waste places, as they do every year, they carry with them all kinds of food fishes. When the floods begin to recede, many of the older fishes find their way back to the streams; but enormous numbers of mature and young fish are left in sloughs, pools, or ponds, which gradually become dry, and the death of all the contained fishes follows as a matter of course; or, if the floods come late in the season and the stranded fishes do not perish from evaporation and seepage of the water, the same result ensues when the shallow pools become covered with ice.

This inviting and important field is entered by the Bureau of Fisheries with numerous crews of fishermen equipped with seines for catching the fish and with receptacles for holding them until they are returned to the parent streams or supplied to applicants in the contiguous territory. The rescue operations are conducted from Minnesota to Mississippi, and the food and game fishes saved every year run far into the millions.

HOW SCIENCE AIDS THE FISHING INDUSTRY

The general public is often restive and sometimes captious when any Federal bureau engages in scientific work to which there is no direct and obvious practical application or from which immediate economic results do not inevitably come. This attitude is reflected upon and responded to by members of Congress, so that it is usually difficult to secure financial support for the inauguration of scientific investigations or for their contin-



A HARD-SHELL CRAB CONVERTING ITSELF INTO A SOFT-SHELL.

The difference between a hard-shell and soft-shell crab is simply one of time. Every now and then the crab needs to grow a little, so its body gets soft and its hard shell splits open. It is then enabled to pull itself out of that shell and to grow while a new one is in the process of forming. When this process is completed, it ceases to be a soft-shell crab and once more joins the ranks of the hard-shells. This change takes place several times a season.

uance unless some practical outcome is shown or reasonably sure of accomplishment.

Fortunately, the Bureau of Fisheries has from the outset been recognized as an institution whose scientific investigations and experiments lead to important practical ends, and the liberal appropriations for this purpose made by Congress year after year are an evidence of the way in which the lawmakers regard this service.

Our artificial propagation of food fishes, which is the most extensive work of the Federal fishery bureau, has reached its present proportions and efficiency entirely through the application to hatching and rearing methods of biological knowledge of the spawning, development, and general natural history of each of the fishes handled—knowledge that has depended on painstaking, long-continued field investigations.

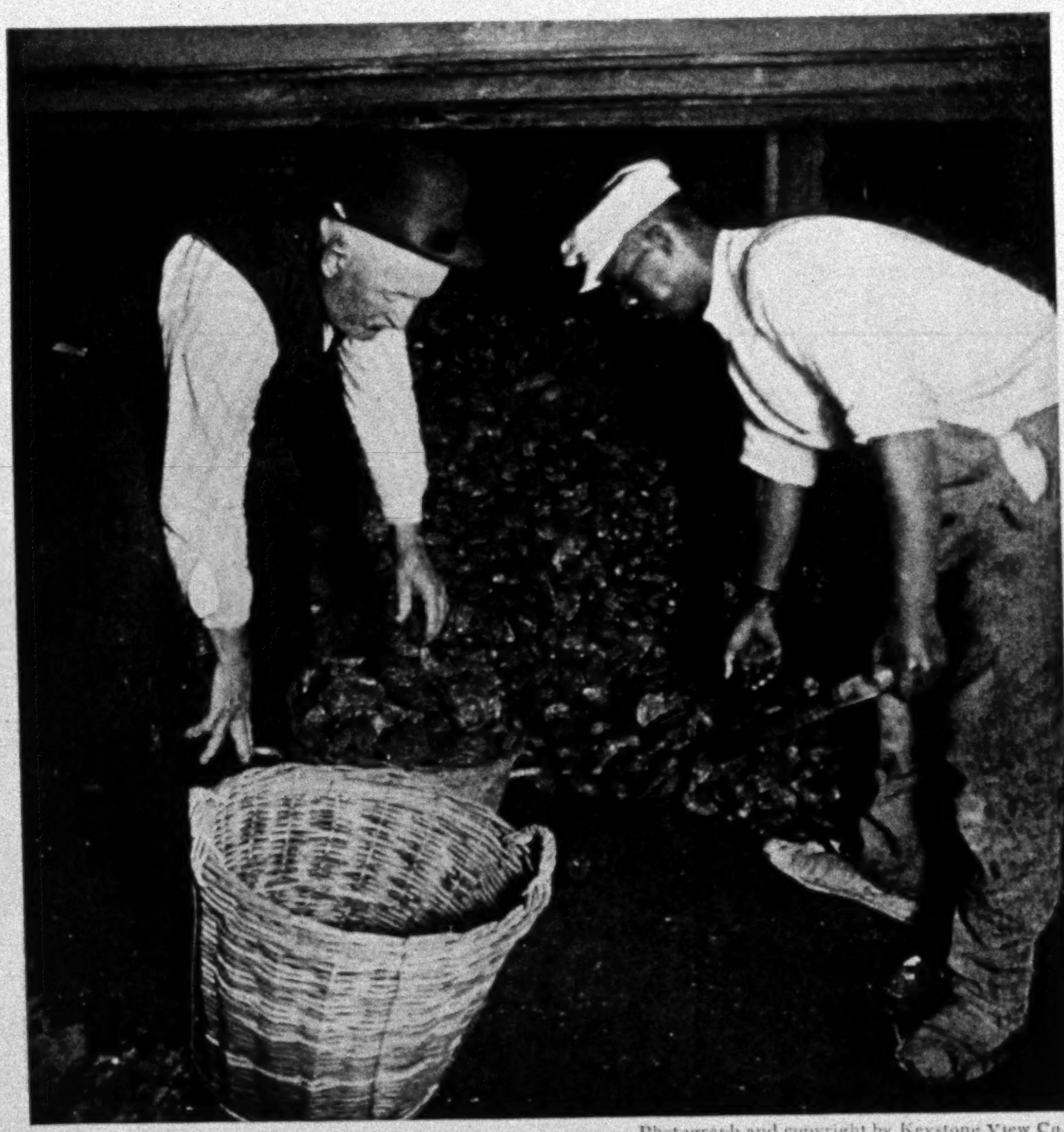
Photograph and copyright by Keystone View Co.

"PICKING" CRABS FOR MARKET ON THE SHORE OF CHESAPEAKE BAY, MARYLAND

The principal crab fishery of the country is in Chesapeake Bay. In 1915 over 15,000,000 crabs were caught in that body of water and sold by the fishermen for about one million dollars. The picture shows the women "picking" the crab meat.

Feasible methods of cultivating aquatic creatures other than fishes, valuable as food or in the arts and industries, have been developed in order to maintain the supply or to save from commercial extinction. Among the conspicuous achievements under this head have been the perfecting of ways and means of rearing the lobster and the diamond-back terrapin and of growing sponges from cuttings. Especially noteworthy has been the development of the oyster-planting industry, as a result of recommendations to the States following surveys of the oyster grounds and barren bottoms.

One of the large tasks which the bureau has set out to accomplish is the perpetuation of an industry in the Mississippi basin, worth $8,000,000 to $10,000,000 annually, by assuring the permanency



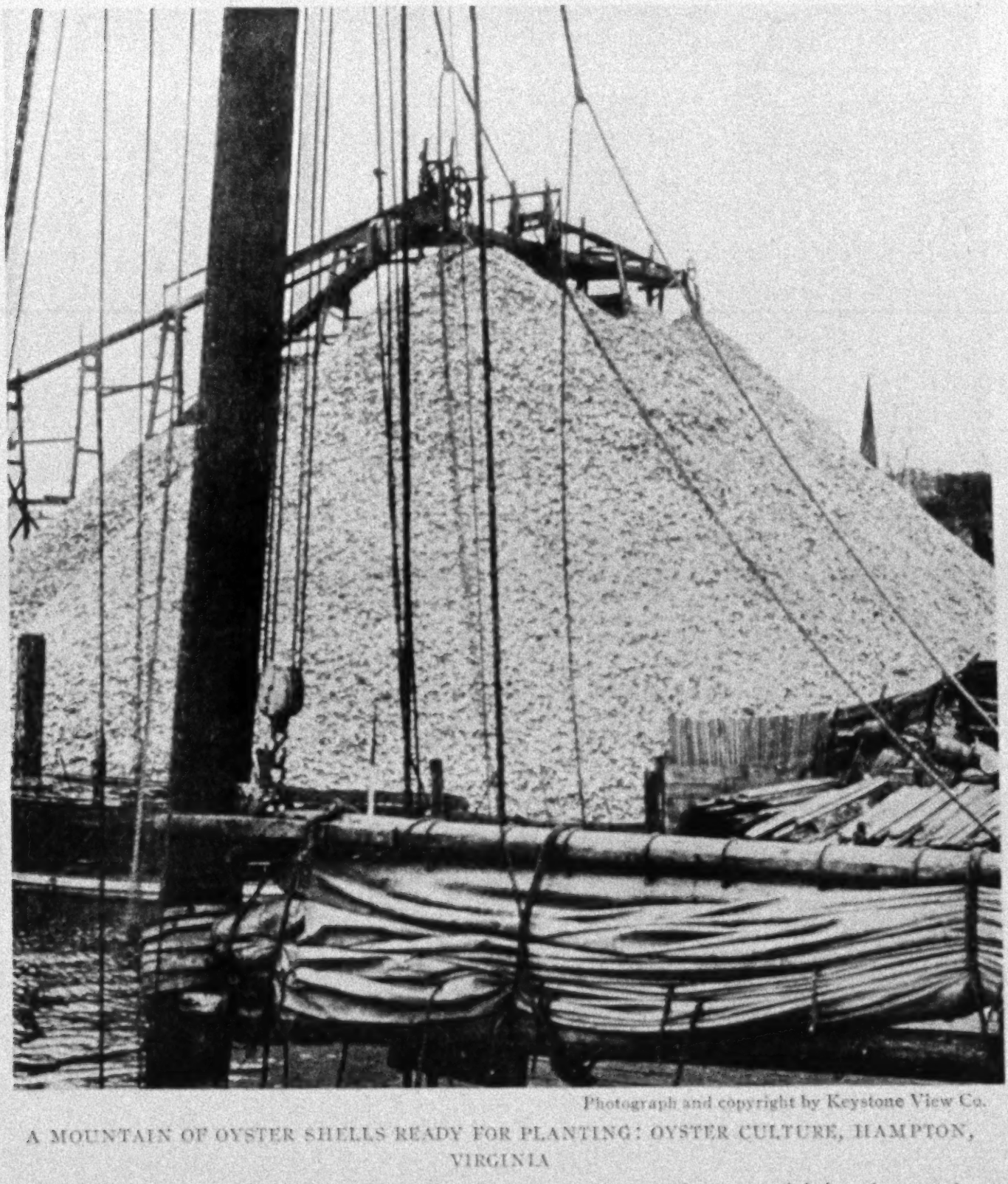
Photograph and copyright by Keystone View Co.

UNLOADING OYSTERS FROM THE HOLD OF A CHESAPEAKE BAY SCHOONER: BALTIMORE

Chesapeake Bay is the leading oyster ground of the world, producing about one-third of the American product, while Baltimore is its foremost oyster market

of the supply of raw materials on which the business depends. A great laboratory has been established on the Mississippi River, at Fairport, in Iowa, and pioneer studies and experiments have there been in progress to determine how the pearly mussels may be artificially increased, so that the many factories making buttons therefrom may not have to shut down following the exhaustion of the mussel beds by unregulated fishing.

An entirely new problem in aquiculture was here presented, and has now been satisfactorily solved through the discovery of the fact that the young mussels, while still in a microscopic larval stage, must attach themselves to the gills of particular fishes in order to develop, and that unless the fishes for which the different kinds of mussels have a selective affinity are available none of the young will survive.



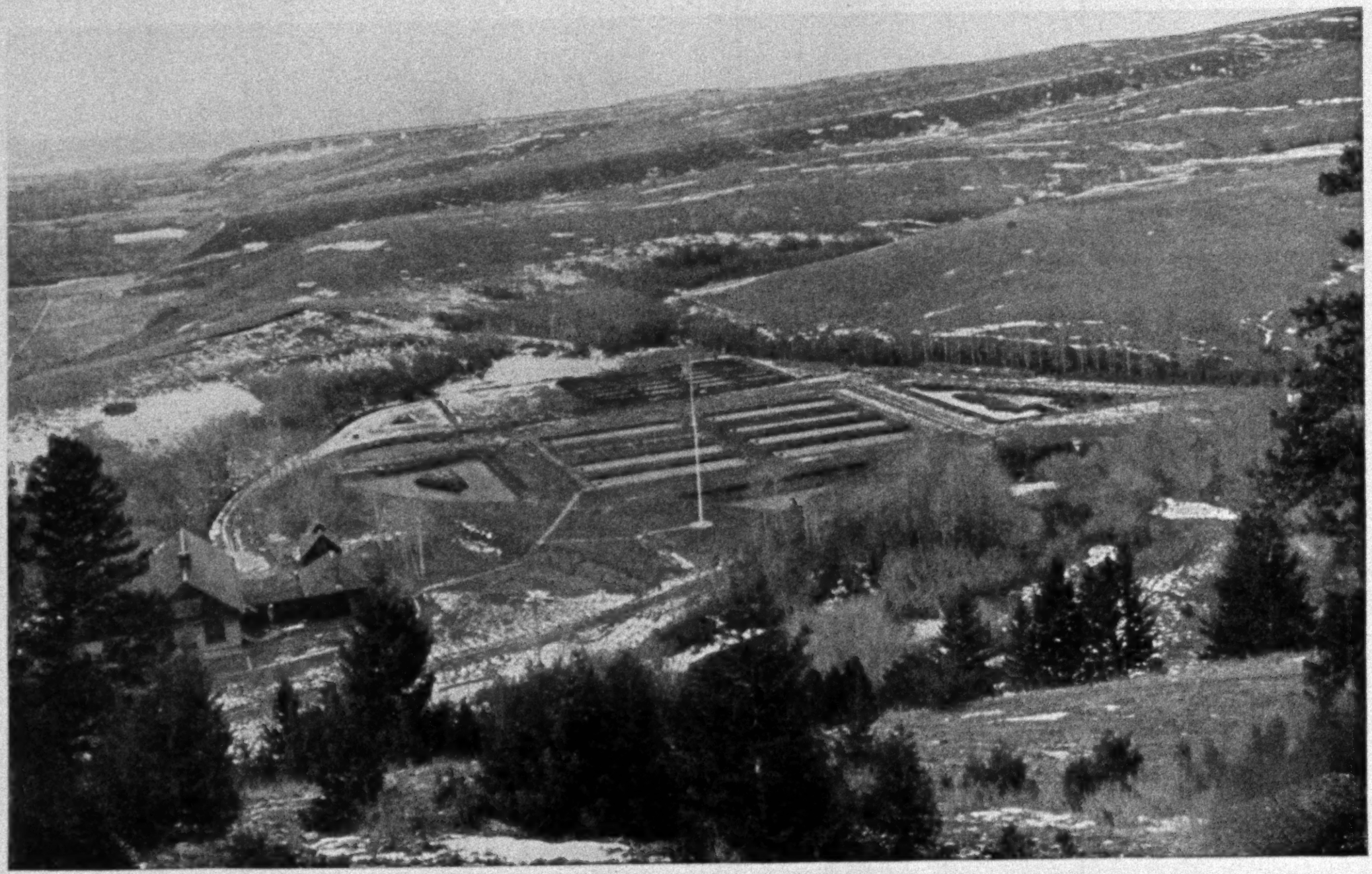
Photograph and copyright by Keystone View Co.

A MOUNTAIN OF OYSTER SHELLS READY FOR PLANTING: OYSTER CULTURE, HAMPTON, VIRGINIA

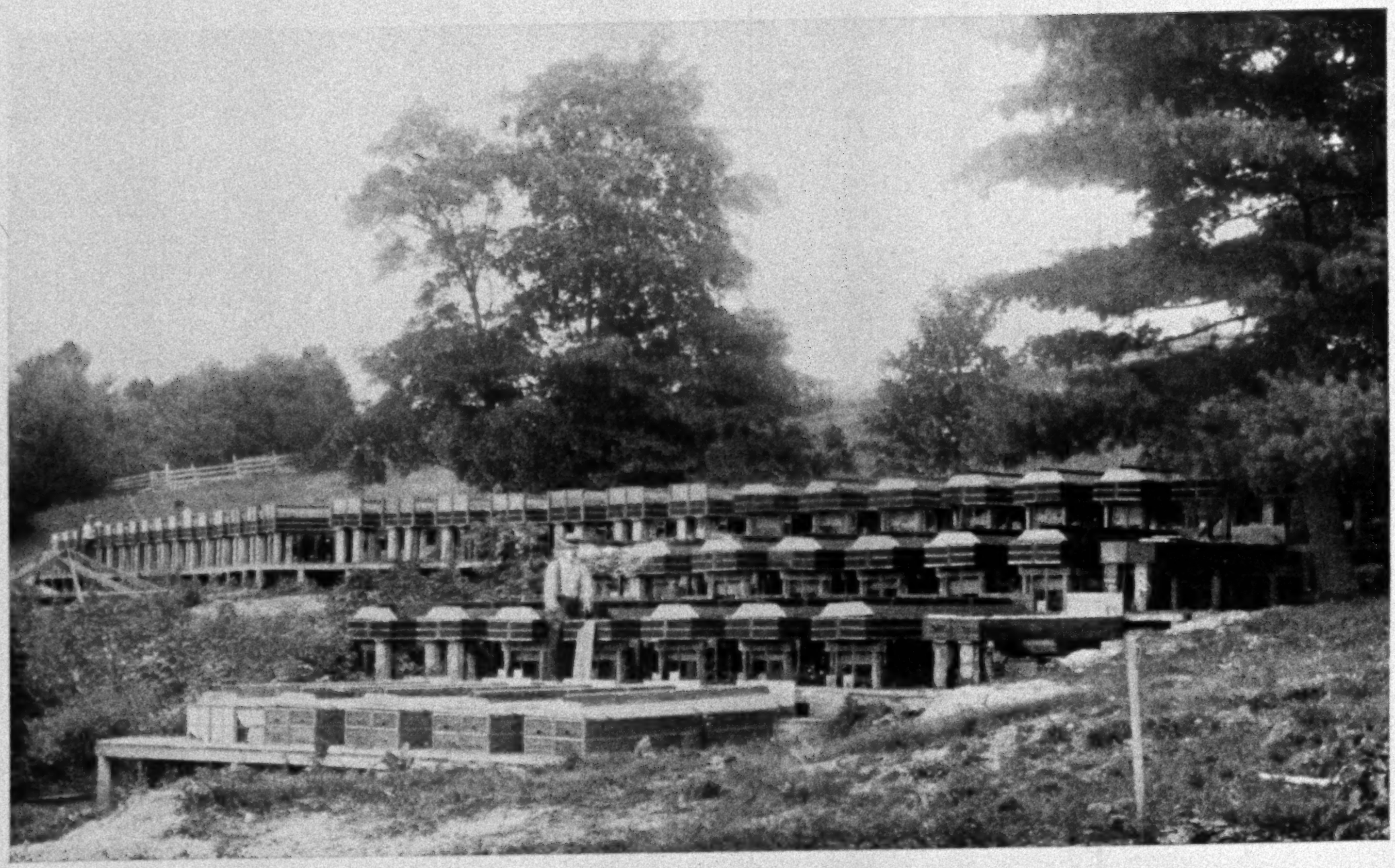
An essential of oyster farming is to spread on the bottom clear material for the attachment and temporary support of the young oysters. When first hatched, they are free-swimming, microscopic creatures, but in a few hours they fall to the bottom and are lost unless they can adhere to a firm, clean surface while making their shells and undergoing development.

The fish hosts of the various important button-making mussels have been determined, and it is the province of the laboratory to provide those fishes and have them inoculate themselves by swimming in tanks or ponds in which the spawning mussels have been placed.

When a fish is sufficiently infected, it is turned loose in the river, and in a few weeks the young mussels, having attained a proper development, become detached from the gills, fall to the bottom of the stream, and begin their independent existence.



BIRD'S-EYE VIEW OF A GOVERNMENT TROUT AND GRAYLING HATCHERY IN MONTANA



OPEN-AIR TROUGHS FOR REARING ATLANTIC SALMON AT A HATCHERY ON THE PENOBSCOT RIVER, IN MAINE

The Penobscot is the only river on our Atlantic coast which continues to have a regular run of salmon, although in early times many streams were visited annually by schools of this fish. The maintenance of the salmon supply in the Penobscot, notwithstanding adverse physical conditions, is due entirely to artificial propagation.

INTERIOR OF A WHITEFISH HATCHERY, SHOWING PECULIAR ARRANGEMENT OF THE JARS IN A "BATTERY"

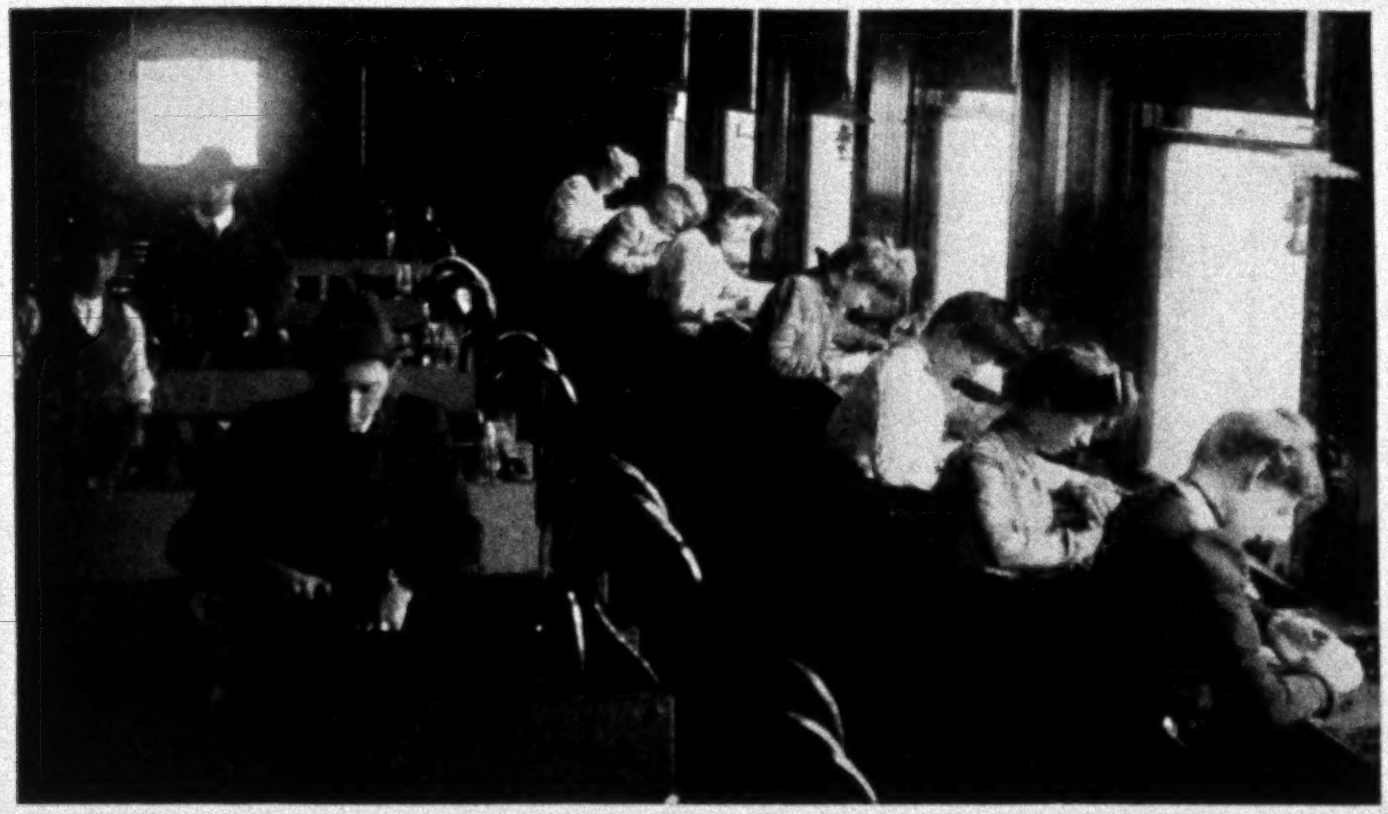
This arrangement economizes space and water and is used throughout the Great Lakes region, where very large numbers of eggs are handled

About 350,000,000 baby mussels were thus inoculated on fishes in 1915 at the Fairport station, and buttons have actually been made from the shells of mussels that had been grown from the larval stage in the laboratory ponds.

FASHIONS IN FISH LIKE FASHIONS IN CLOTHES

For some years the Bureau of Fisheries has been conducting experiments to show the potential value of aquatic resources that are either wholly neglected or only inadequately utilized in the United States, and has inaugurated several campaigns to induce our people to eat new fish and other water products. This is one of the most important services that can be rendered to a nation, and the success of some of these efforts has encouraged the hope and belief that results of large economic significance may be obtained from various other articles to which fishermen, dealers, and the public are now indifferent.

There are fashions in fish just as there are fashions in clothes. The American public has from the beginning been fastidious and fickle in its tastes for aquatic foods and has been loath to accept articles which other countries long ago adopted as staples.



PICKING OUT BAD EGGS IN A MICHIGAN TROUT HATCHERY

Many millions of lake-trout eggs are here incubated, and the trays containing the eggs have to be carefully examined daily in order to remove the dead ones, which, if left in contact with those that are sound, would impair their vitality or communicate disease to them. The "deads" are picked out with tweezers by a body of trained girls temporarily employed for this purpose.

A FISH-DISTRIBUTING CAR BEING LOADED FOR A TRIP

There are more than 6,000,000 farms in the United States. If there were a fish pond on every farm and each family took only three pounds of fish a week, more than a billion pounds of extra food a year would be secured, releasing a corresponding amount of other meat for city consumption, and consequently having a reflex upon the high cost of living.

GOVERNMENT MESSENGERS PLANTING FISH

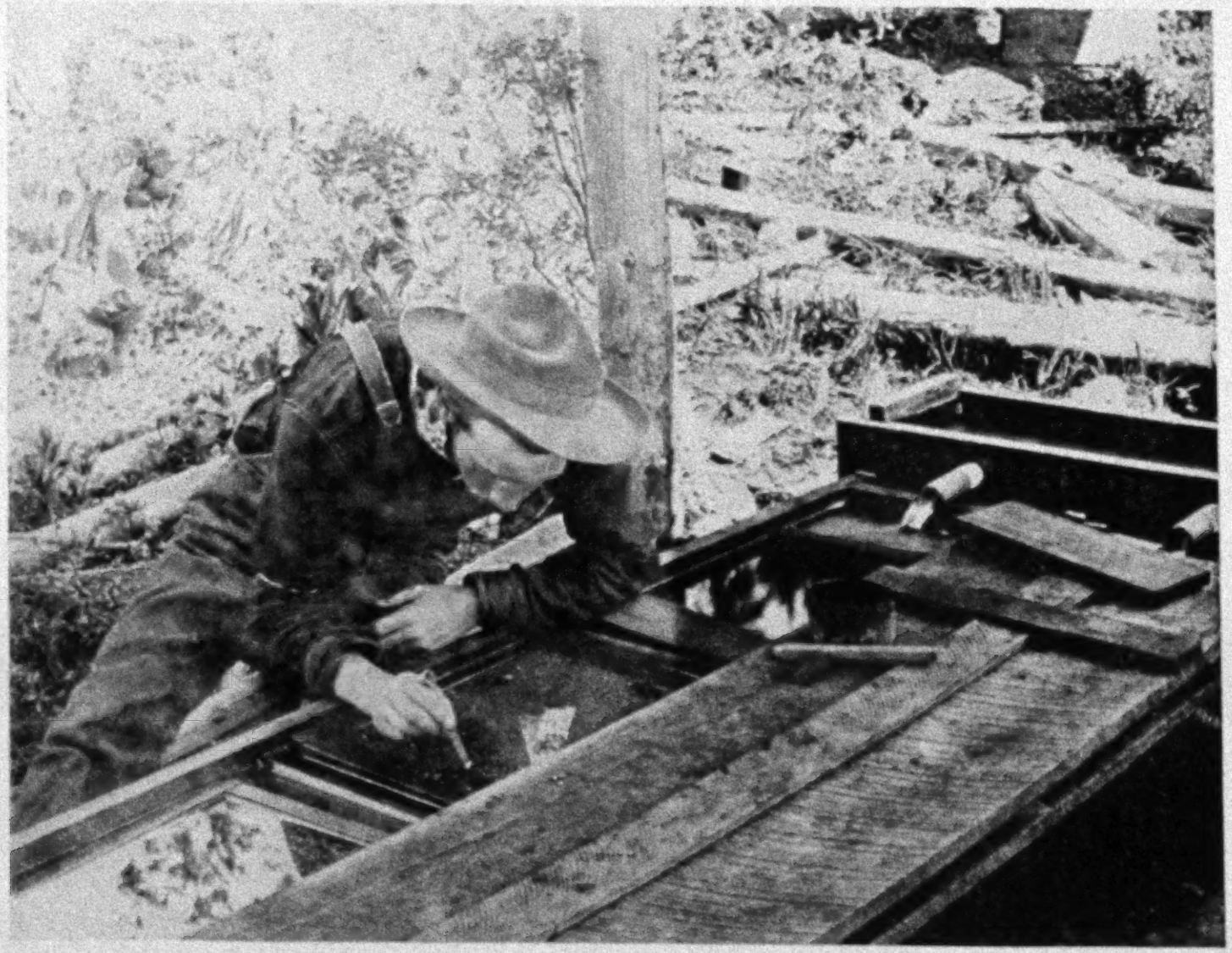
Before transferring fish from cans to an open stream, it is necessary gradually to bring the water in the cans to the approximate temperature of that in the stream; otherwise the fish will experience a shock.

The great wealth of our waters has made it possible for our people peremptorily to discard much and to choose the best, or what they regarded as the best; and the early development of the fisheries has been characterized by the rejection of wholesome aquatic products that have now taken a prominent place in the market after years or generations of neglect or disrepute. In fact, in every important fishing region people are still living who recall the time when ignorance and prejudice placed a ban on certain aquatic foods which have since become valued commodities in the identical sections where they were formerly condemned or ignored.

Among the well-known examples of water resources that were once wholly or largely neglected, but are now extensively utilized, or are beginning to be more generally appreciated, are the haddock and the winter flounder on the north Atlantic coast; the tunny, the shad, and the minor salmons of the Pacific seaboard, and the sea mussel of New England.

Especially noteworthy has been the recent establishment of a tunny fishery and a very extensive tunny canning industry in southern California. Of the hundreds of thousands of people who now regularly eat the delicious canned "tuna," few realize that a few years ago not a single fish of this species was utilized in America, and that our entire supply came from the Mediterranean.

Another conspicuous case has been the recent development in southern New



PICKING EGGS AT THE GRAND MESA FIELD STATION, COLORADO

The Bureau of Fisheries maintains upward of one hundred field stations, some of the most important being in Colorado. The eastern brook trout, originally introduced into Colorado from New England, is now more successfully propagated there than in any other State, and is being sent back east in large numbers to replenish Atlantic seaboard streams.

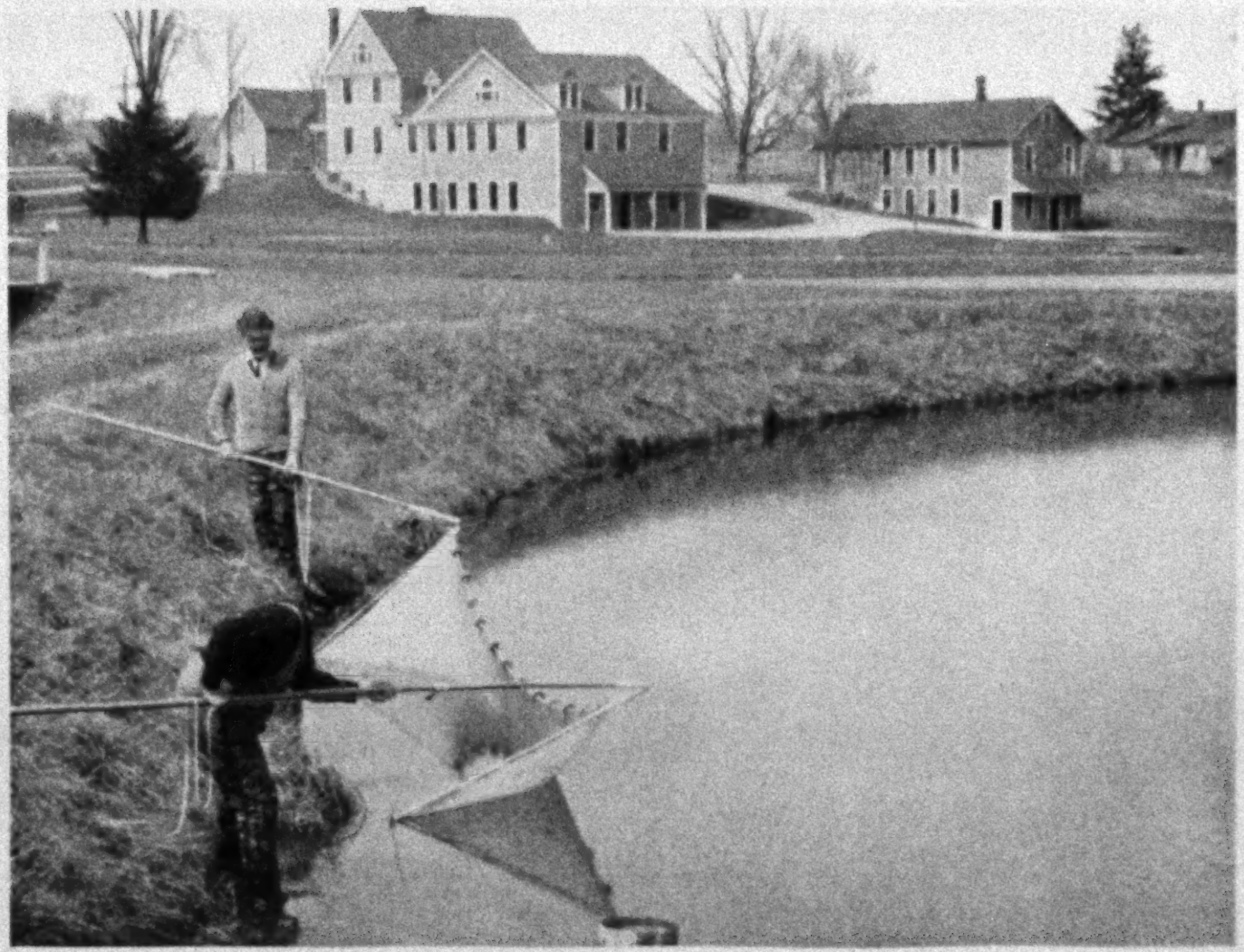
England of a very important fishery for the winter flounder carried on with trawl nets. Formerly only comparatively small quantities of this fish were caught for market, but now millions are taken annually, and thousands of fishermen are making a livelihood in this new fishing industry.

The Bureau of Fisheries long ago called attention to the value of this fish and began its artificial propagation, so that at present, the methods of culture having been perfected, the government is producing a billion or more young flounders each year and planting them in the regions where the fishing is most active.

THE CASE OF THE SEA MUSSEL

A noteworthy case of neglect, followed by appreciation and utilization, is that of the sea mussel, one of the best and most abundant of marine foods. Hundreds of millions of pounds are eaten annually in western Europe, but in the United States practically the only use made of them has been for fertilizer and bait.

In 1914 an advantageous opportunity was presented for introducing this mollusk in one of the prominent Boston hotels, and through the assistance of the newspapers the experiment attracted so much attention that within a few months mussels were, for the first time, being served and given a conspicuous place on the menus of over seventy of the principal hotels, clubs, and restaurants of Boston. The demand naturally spread to private houses and to adjacent communities, with the result that the mussel has become a regular commodity of the



GETTING FISH FOOD FROM A POND AT A MICHIGAN HATCHERY

Young trout and bass subsist naturally on small crustaceans and other living creatures, and the best and hardiest fish are produced when the fish-culturist is able to supply this natural food.

region, to the benefit of consumer, dealer, and fisherman; and the knowledge of the food value of the mussel has gradually extended to other cities, and its regular consumption over a wide area, both adjacent to and remote from the seaboard, is assured.

That a very extensive mussel fishery will be developed on our Atlantic and Pacific coasts is inevitable. Mussels occur in vast beds as yet untouched and easily reached by tongs and dredges. They are as nutritious as oysters and clams, and, their shells being thinner, a given quantity contains more actual food than does the same bulk of oysters.

A further advantage is that they are in season at all times and are at their best on the New England and middle Atlantic coasts when the oyster supplies in the markets are most reduced, namely, in summer.

The most advertised fish in the United States during the past eight months has been the tilefish. The advertising was undertaken by the Bureau of Fisheries in order to make known to the public an abundant, palatable, and neglected food fish occurring on the east coast of the United States in a region readily accessible to the principal markets. The fact that an astonishing amount of interest was thus aroused depended in part on the merits of the propaganda and in part on the romantic and tragic history of the tilefish.

THE ROMANCE OF THE TILEFISH

The tilefish holds an absolutely unique place in nature, science, and industry. So far as records go, no person had ever seen a tilefish prior to May, 1879, when Captain Kirby, fishing in a Gloucester schooner south of Nantucket, caught in deep water several thousand pounds of a

A PACK-TRAIN OF HORSES LADEN WITH CANS OF YOUNG TROUT FOR PLANTING IN A COLORADO LAKE

The jolting of the cans is of advantage to the fish, as it serves to aërate the water

"strange and handsomely colored fish." He sent a specimen to the United States Fish Commission, of which the present Bureau of Fisheries is the direct descendant, and ichthyologists in that establishment discovered it to be new to science and named it *Lopholatilus chamæconticeps*. A less worthy fish might never have been able to attain popularity under such a handicap name, which, being interpreted, means simply the tufted chameleon-headed tilus. A short name, adapted for common use, was obviously needed, so the sponsors for the new species perpetrated a pun on a syllable of its generic name and called it "tile" fish.

The Commissioner of Fisheries at that time, Prof. Spencer F. Baird, at once began investigations to determine the location and extent of the grounds on which the tilefish occurred, the abundance of the fish, and the possibility of establishing a commercial fishery.

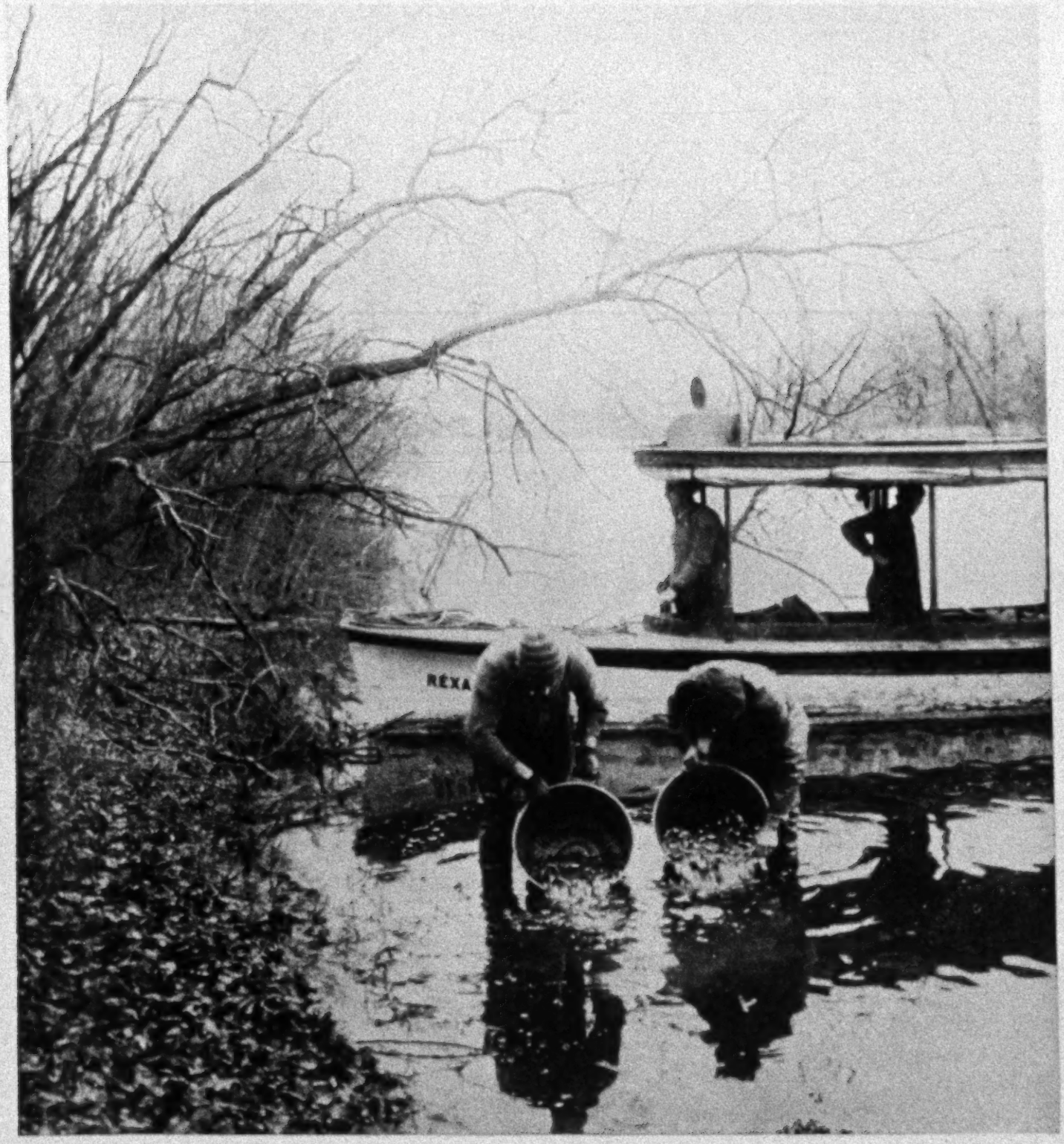
In less than three years, however, and before the plans of the Commissioner were completed, the tilefish met with a cataclysm which resulted in its apparent extermination. News of the disaster was brought in by the master of a ship in March, 1882, who reported that he had sailed for 69 miles through dead and dying tilefish that thickly covered the surface off the middle Atlantic coast.

Various other reports to the same effect were received in March and April, and it was computed that an area 170 miles long and 25 miles wide was covered with dead fish, whose number was estimated at 1,400,000,000. No such catastrophe had ever befallen any other fish in the history of the world and speculation as to its cause was rife.

The Bureau, through its investigations before and after the event, was able to offer an explanation which has been generally accepted. The tilefish, while a bot-

RESCUING FISH FROM A MISSISSIPPI RIVER SWAMP

On June 1, 1915, this bayou covered 11 acres, and on November 15, 1915, it had wasted away to a pool 35 feet by 50 feet and 14 inches deep in the deepest part. Some of the fishes had been seined out earlier in the season, but on the final clean-up 150,000 were rescued and removed to open water. They comprised more than ten species of food and game fishes, including 30,000 catfish, 15,000 crappie, 25,000 sunfish, and 15,000 buffalo-fish.



PLANTING FISH IN THE OPEN WATERS: A RESCUE PARTY ON THE MISSISSIPPI

Fish not wanted for distribution to applicants are transferred in tubs and liberated in the open river

tom species, inhabiting moderately deep water, was, unlike most bottom fishes, a lover of warm water and found congenial haunts on a narrow strip where the Gulf Stream touched the edge of the continental shelf. There is evidence to show that about the time in question the Gulf Stream was receding, or moving offshore, and that its warmth eventually ceased to bathe the bottom frequented by the tilefish, which therefore came under the influence of a cold inshore current that took the place of the Gulf Stream. Being unable to adapt itself to the new conditions or unable to find new grounds where the depth and temperature were congenial, the tilefish in reality succumbed to a cold wave.

U. S. FISHERY STEAMER "ALBATROSS" AT ANCHORAGE IN RESURRECTION BAY, ALASKA, WHILE ENGAGED IN INSPECTION WORK

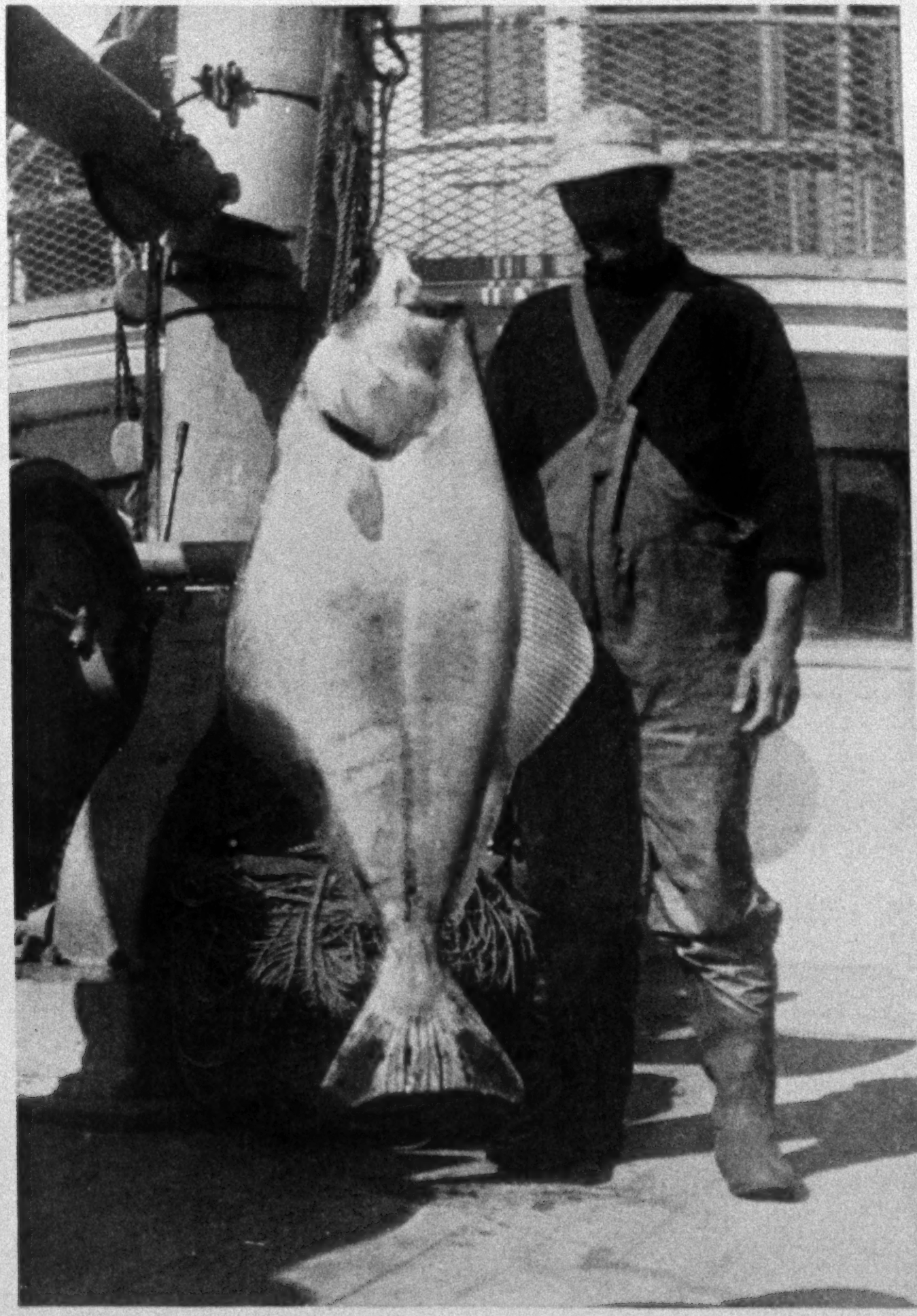
The United States annually takes from the waters of Alaska fish valued at more than three times the price we paid for that wonderful territory (see text, page 557)

Some years later, when the Gulf Stream was still "off soundings," investigation showed that it was approaching the coast, and the prediction was made that about 1892 it would again be flowing over the grounds on which the tilefish had once abounded.

The prediction was verified, and it is noteworthy that in the year named, after ten years of persistent search, during which not a single specimen was found, the Bureau's schooner *Grampus* caught a few tilefish in the old haunts. Evidently a remnant had survived, probably far to the south, and the fish had gradually worked back to the region formerly frequented. From that time on the species quickly reëstablished itself and soon became apparently as numerous as ever, so that today it occurs in great abundance along the 100-fathom line from a point south of the Nantucket Shoals lightship to a point southeast of Atlantic City and possibly much farther south.

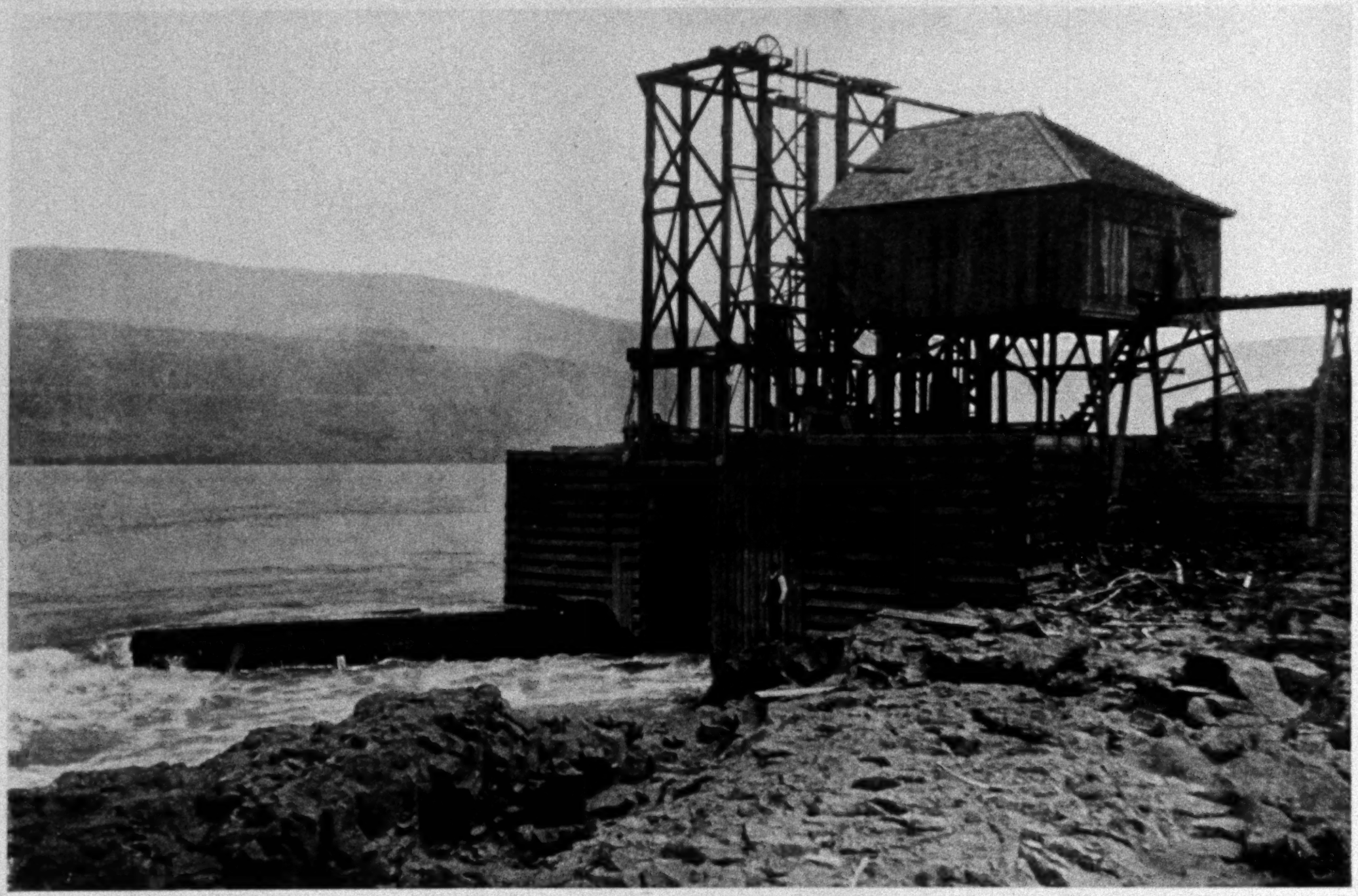
Believing that the food qualities, accessibility, and abundance of the tilefish warranted an attempt to establish for it a commercial fishery, the Bureau of Fisheries, in October, 1915, undertook the triple task of inducing the fishermen to catch the fish, the dealers to handle it, and the public to buy and eat it.

So successful were these efforts that, within one month of the date when the demonstration was begun, the Bureau was able to withdraw from the field and turn the project over to the commercial interests. A regular fishery has been inaugurated by Massachusetts, New York, and New Jersey vessels, of which more than twenty have been engaged at one time; and up to June 1, 1916, or in less than seven months, over 1,700 tons of tilefish, yielding the fishermen more than $200,000, had been caught and sold, chiefly in New York City, whence the product has been distributed over a large area, extending as far west as Chicago



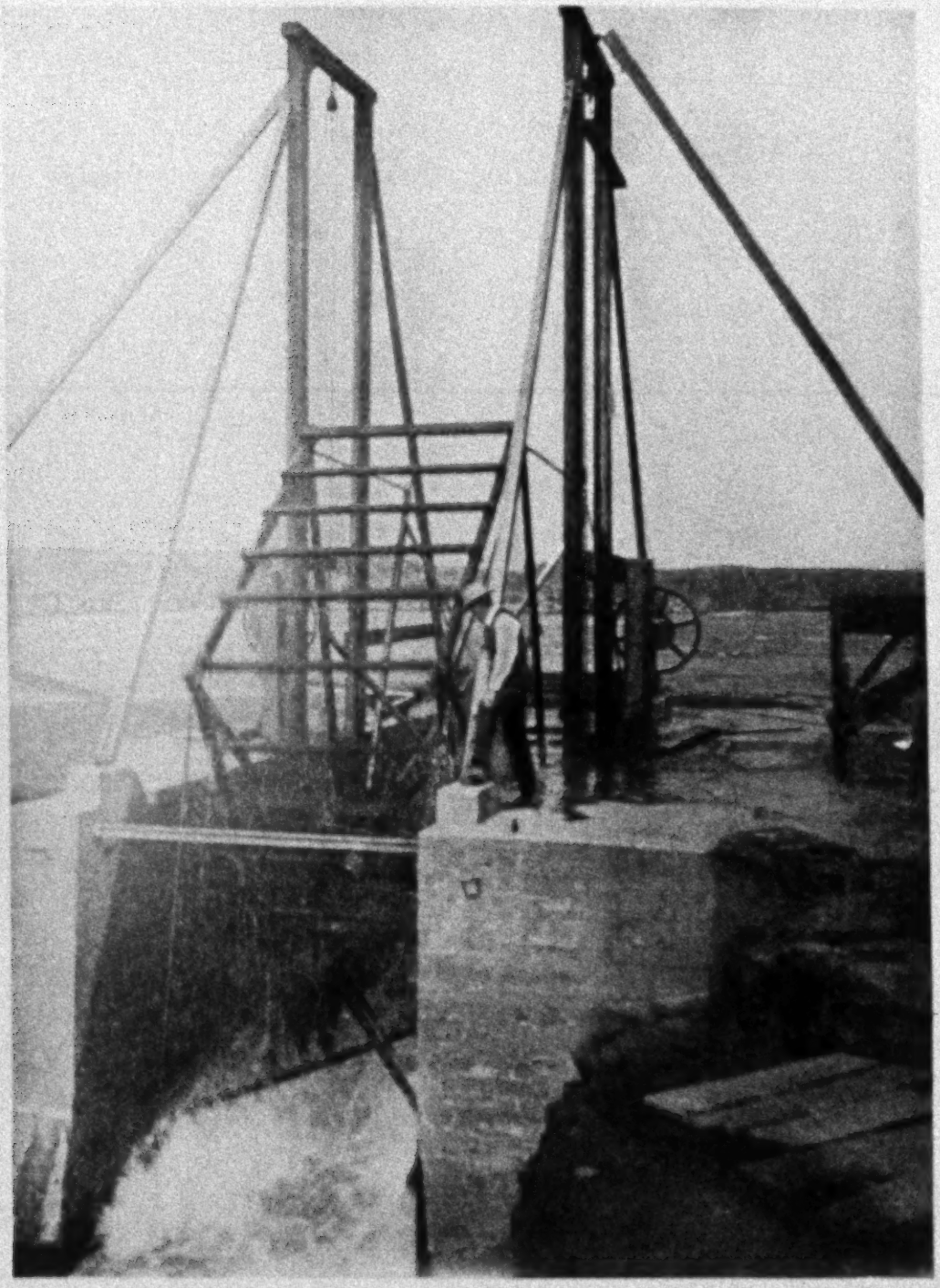
A 100-POUND HALIBUT CAUGHT BY THE U. S. S. "ALBATROSS" WHILE SURVEYING NEW AND LITTLE-KNOWN FISHING GROUNDS ON THE COAST OF OREGON

Large additions to the local food supply and good opportunities for the establishment of new fisheries have come from this work of the *Albatross*



Photograph from Henry O'Malley

A COLUMBIA RIVER SALMON WHEEL



Photograph from Henry O'Malley

NEAR VIEW OF A FISH WHEEL: COLUMBIA RIVER, OREGON

The salmon wheel reaches its highest perfection in the Columbia River, but is used also in parts of Alaska. It consists of a series of net compartments arranged in the form of a huge wheel, supported on a scow or on a crib-work, cement, or masonry base. The wheel can be used only in rapid water, as it is turned by the current and catches the fish swimming upstream. The above wheel, with a solid cement base, is operated at The Dalles.

and St. Louis and as far south as Atlanta.

AMERICA'S FUTURE SUPPLIES OF AQUATIC ANIMALS

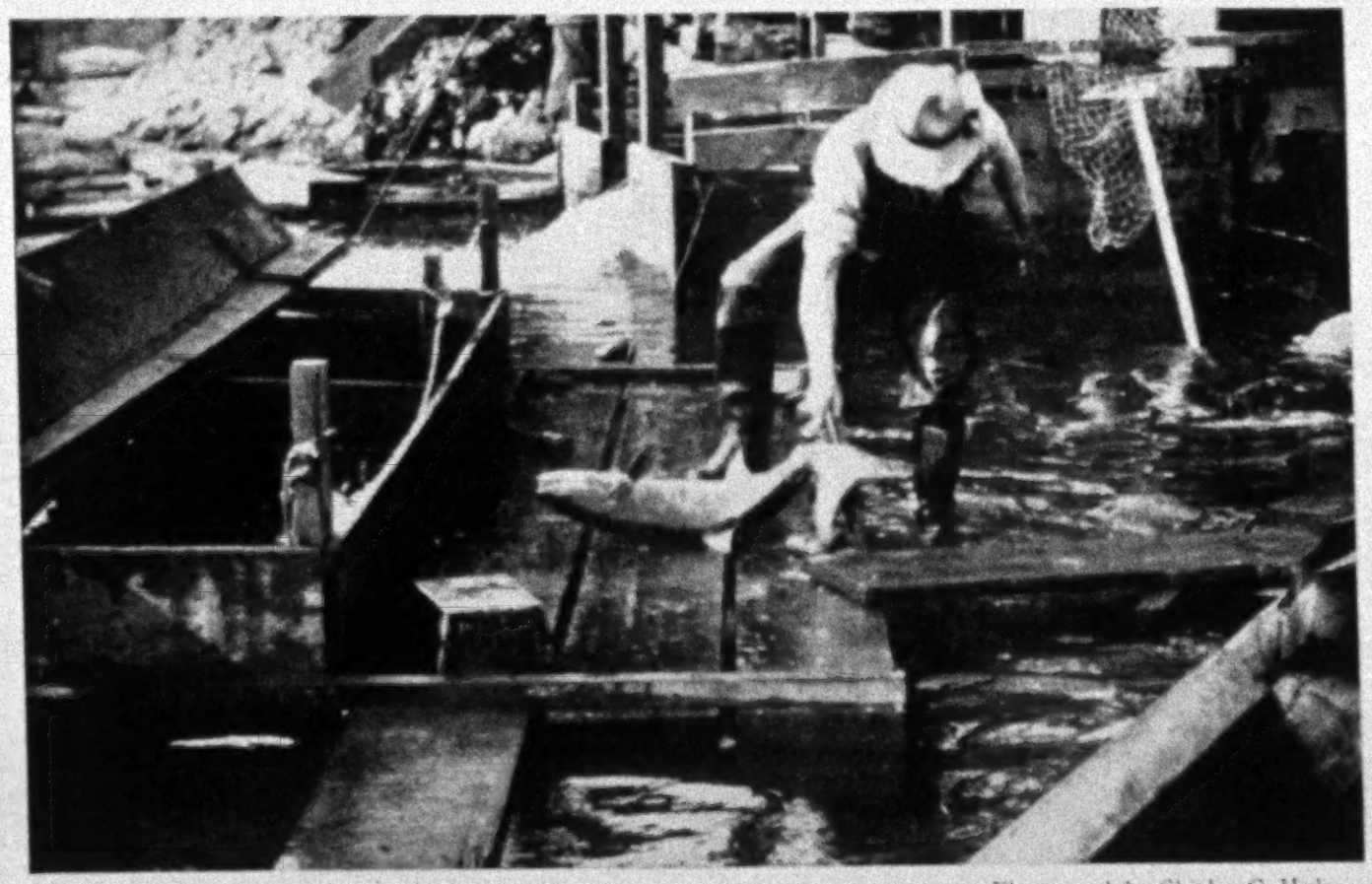
Thoughtful people everywhere are asking the question whether our wonderful aquatic resources will continue without essential impairment and be an important source of food and wealth for generations yet to come, or whether the unmistakable decline which has befallen some of our most valuable products is but a forerunner of a condition to which all of our water animals are inevitably and speedily tending. We may profitably indulge in a little speculation regarding this question, with the history of the older nations to guide us.

There is every reason to feel assured that our great high-sea fishing grounds will remain productive and continue to

Photograph from John N. Cobb

A REMARKABLE PICTURE OF SALMON SPAWNING ON A GRAVELLY RIFFLE IN A PACIFIC COAST STREAM

There are five species of Pacific salmons, and all of them have the remarkable habit of dying after once spawning. This applies to both sexes, and was a wise provision of nature to prevent overstocking. The only other American food fish with this habit is the common eel, which spawns and dies at sea.



Photograph by Shirley C. Hulse

GATHERING EGGS FOR GOVERNMENT HATCHING

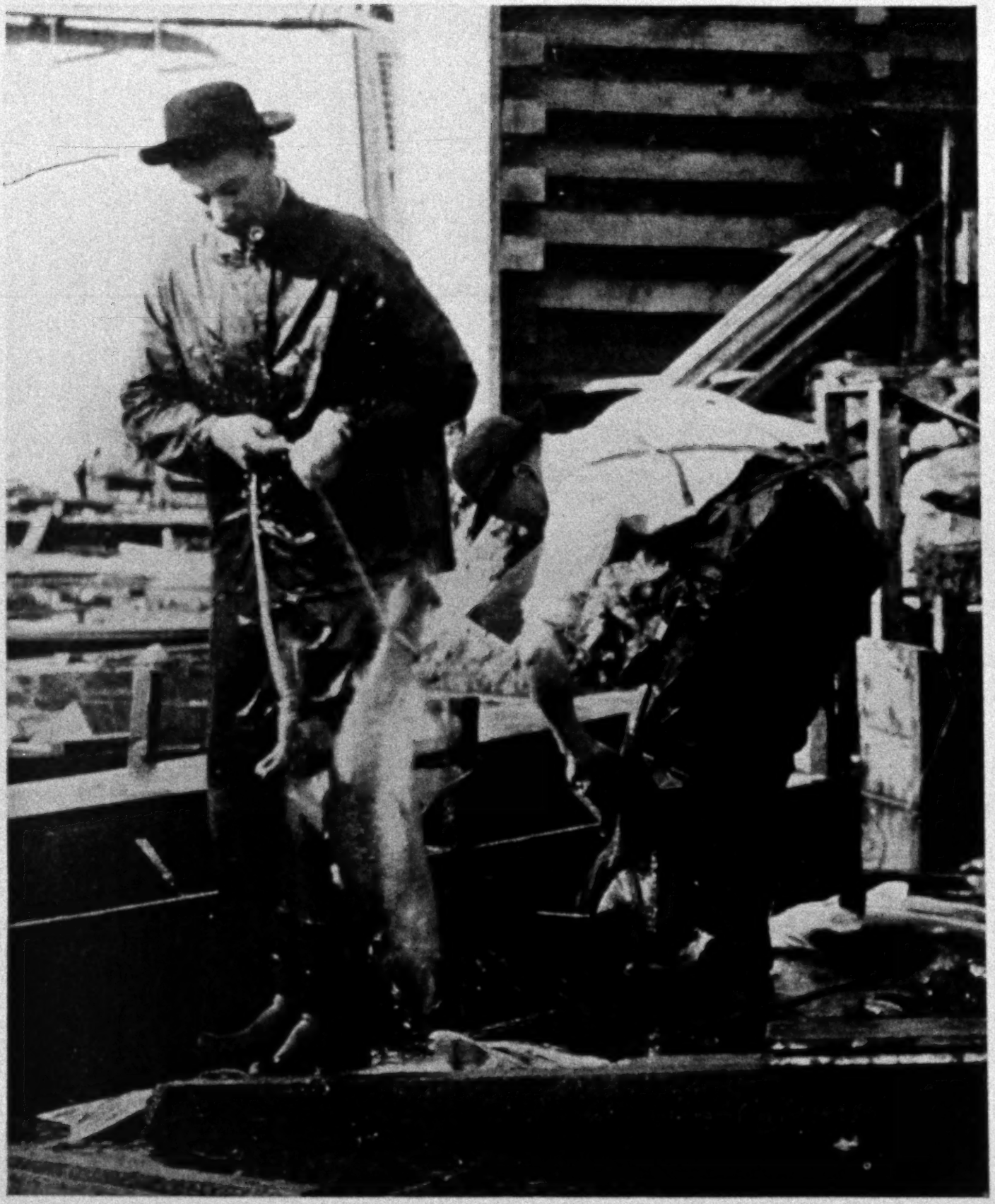
The male fish ("bucks") are put alive in the floating box shown in the left of the picture. The females ("does") are stunned by a blow on the head, after which their tails are chopped off. This bleeds the fish, and, later, when they are ripped open and the eggs removed, no blood appears. Should any blood get in the eggs, they would not hatch.

support valuable fisheries, subject to seasonal or periodic fluctuations, such as have always characterized free-swimming oceanic fishes as far back as authentic records go. Periods of great scarcity, such as have come to the bluefish and the mackerel on the Atlantic coast of the United States and to the sea herring on the Atlantic coast of Europe, are to be expected, just as are periods of abnormal abundance, such as characterized the menhaden in 1913 and the swordfish in the western Atlantic for the past few years.

It may confidently be expected that our coastal waters will continue to contribute their large quota of fish, crustacean, and molluscan foods, provided the attitude of the various States toward their fisheries is helpful. Inasmuch as many of the most valuable animals inhabiting the coastwise waters may be very injudiciously affected by improper methods and inadequate regulation, it follows that the proper handling on the part of the States will maintain the supplies or restore depleted resources. Furthermore, a very marked increase in the abundance of fishes and shellfishes may result from the institution of wise cultural operations under State encouragement.

In the Great Lakes and the major streams the future output of fish will be governed very largely by adequate, uniform, or harmonious interstate or international regulations. The serious decline that has characterized some of the principal fisheries in these waters is directly attributable to the failure of the States to appreciate the non-local character of the fishery question; the restoration of the depleted resources and the maintenance of the supply hereafter will depend on the realization by the States that they cannot ignore the nation-wide aspects of the situation, and that they cannot legislate for themselves alone. Fish culture, however effective or potent, cannot, unaided, remedy a condition that it was unable to prevent.

It is becoming more and more evident that, with the increase in population re-



Photograph by Shirley C. Hulse

BUCK SALMON CAUGHT AND HELD READY; OREGON

sulting in increased demands and with the injury to the fish life in streams resulting from obstructions and pollutions, the future fish supplies from our minor fresh waters must depend largely on cultivation, and that an important part of the fish consumed in suburban and country communities remote from the coast or large water-courses will result from private aquiculture

Already a very marked change has occurred in the natural productive capacity of many of the minor fresh-water streams and lakes, and further far-reaching

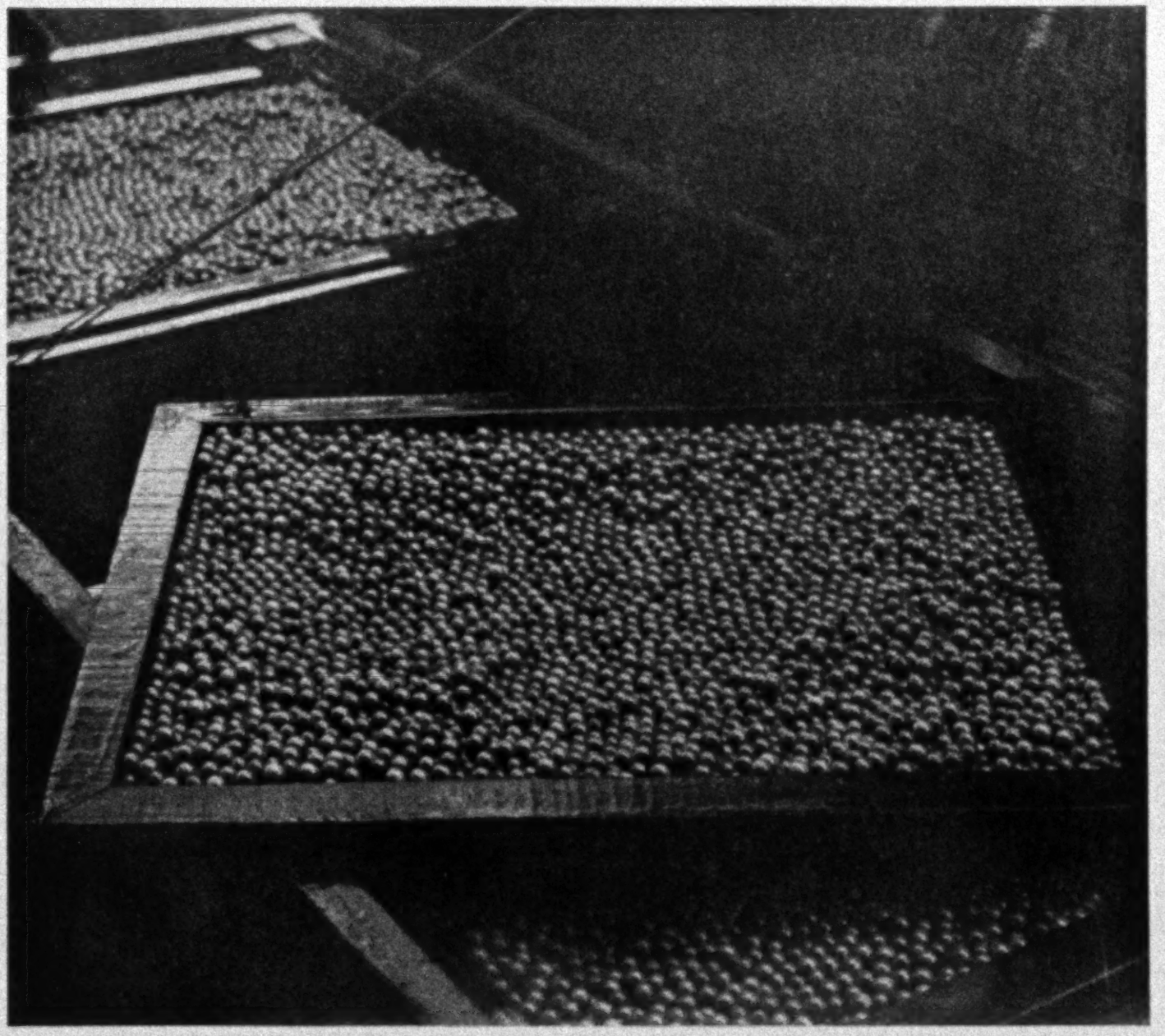
Photograph by Shirley C. Hulse

FERTILIZING THE SALMON EGGS: OREGON

It sometimes requires two men to handle a large buck. As soon as the "milt" is in the pan with the eggs, a little water is added and the whole stirred until the mass of eggs is thoroughly impregnated.

changes are imminent. Various streams, particularly on the Atlantic slope, have ceased to be reservoirs of fish life and have become mere vehicles for the discharge of factory and city refuse; other streams, owing to the creation of dams, long ago ceased to be available for schools of migratory fishes that formerly resorted to them every season.

These were premonitory and for the most part neglected signs of conditions that are gradually arising all over the country. It may be doubted whether our industrial development is incompatible with the preservation of the physical and biological characters of our streams; but the history of other countries and the precedents afforded in our own country clearly indicate that, when the time comes to decide, the fisheries have to yield to



SALMON EGGS ON TRAYS READY FOR SHIPMENT

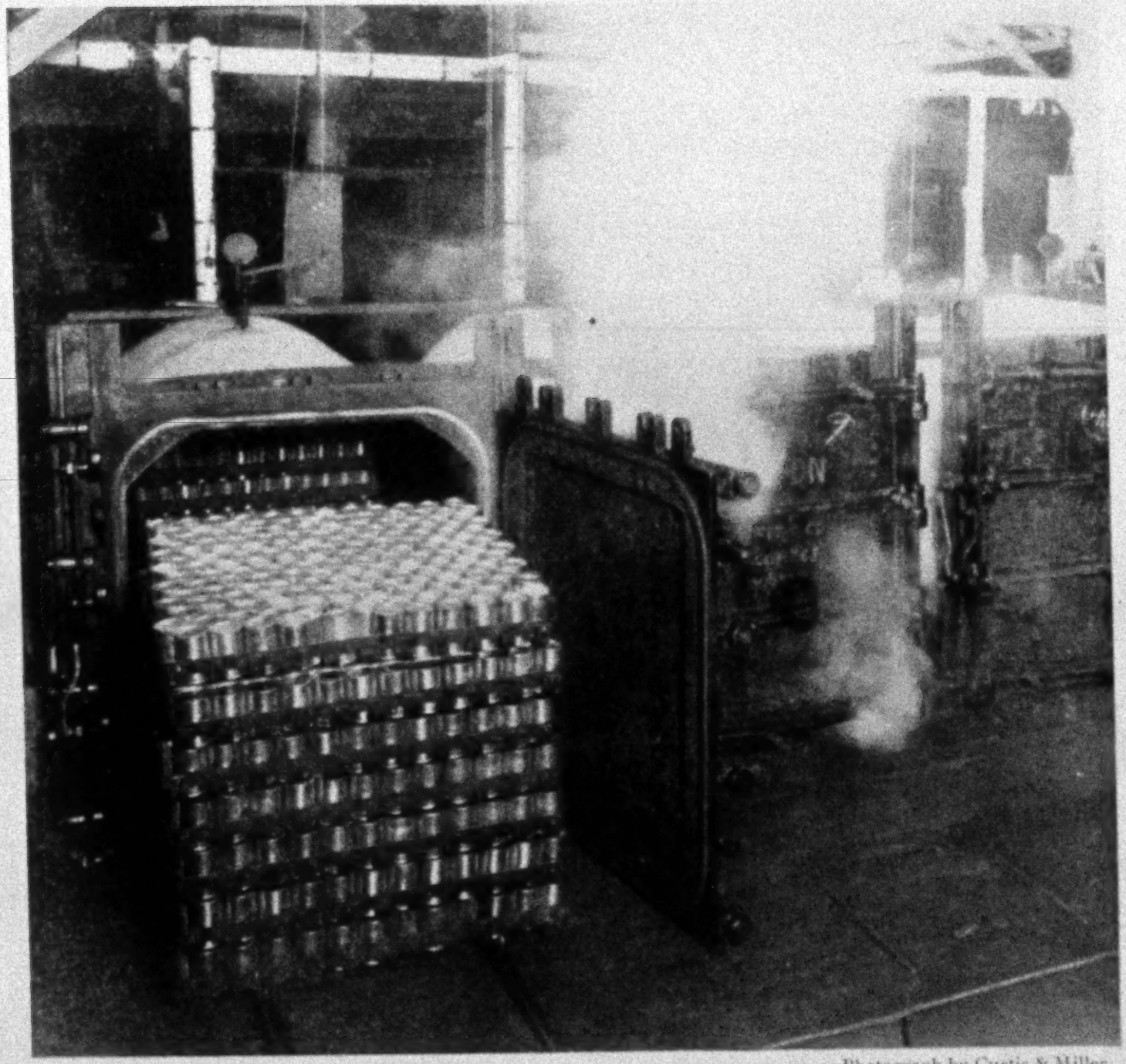
Eggs are packed in this manner for transfer between hatcheries and for distant shipment, as to foreign countries. The eggs packed in a case can, if kept cool and moist, remain out of water for several weeks without impairment. One hundred thousand eggs may be carried in a case.

what are adjudged more important interests.

The greatest problems that will hereafter affect the fish supply for a large part of the United States will be (1) how to replace or compensate for the large quantities of food that will have been cut off by the appropriation of waters for purposes incompatible with fish life; (2) how to make good the shortage in waters that continue to be overfished and have a declining yield, and (3) how to provide a fish food for the rapidly increasing population in regions having no major waters on which to draw.

The solution must be found in the general inauguration of private fish culture, which must necessarily reach its highest utility on farms and be conducted incidentally to the various branches of agriculture and animal industry.

A substantial start has already been made in this direction, and the Bureau of Fisheries has supplied hundreds of millions of artificially hatched food fishes for stocking hundreds of thousands of minor, private waters; but only a small proportion of the farms in the country are as yet equipped with fish ponds or fish lakes, and a great obligation now de-



Photograph by Curtis & Miller

A RETORT WHICH COOKS TWO THOUSAND CANS OF SALMON AT A TIME

Here they are given the final cooking under steam pressure. While large quantities of salmon are sold in a fresh, salted, or smoked condition, by far the major part of the catch is canned. In 1915 the pack of canned salmon in Alaska and the Pacific States exceeded 6,500,000 cases of 48 one-pound cans, valued at $30,000,000.

volving on the fishery service of the United States and of the various States is to make known the possibilities of private pond culture and to provide the necessary stocks of fishes suitable for different waters in different parts of the country.

The ample experience of private fish culturists in all parts of the country confirms the opinion often expressed by national and State fishery officials, that under given conditions aquiculture may be more profitable than agriculture; that an acre of the best water may yield larger returns than an acre of the best land, and that food supplies of untold volume and value may be expected from what are now unused waters.

COMMON AMERICAN WILD FLOWERS

In this number, pages 591 to 606, the GEOGRAPHIC MAGAZINE, *at very great expense, prints another series of colored pictures of Common American Wild Flowers. These exquisite paintings, as well as the subjects of the previous series, were drawn from life by Mary E. Eaton, of the New York Botanical Garden, the able director of which, Dr. N. L. Britton, has cordially coöperated in their preparation.*

In future numbers the GEOGRAPHIC *will present additional paintings of native wild flowers.*

No out-of-door interest brings to old and young richer returns in entertainment and instruction than is found in making the acquaintance of our wild flowers. Many of these, such as the daisy, mullen, aster, blue-flag, etc., are so plentiful that they may be picked at will; but there are others—for instance, the May-apple, spring beauty, lupines, lady's-slipper, etc.—which may become as rare as the trailing arbutus unless every one unites to preserve them. So it is to be hoped that the city dwellers who on their automobile excursions thoughtlessly cut and bring back great branches of dogwood and baskets laden with our rarer wood flowers will soon realize that, unless their plucking be tempered with judgment, the suburbs of all our cities will in the not-distant future be bereft of many of these flower treasures.

FORGET-ME-NOT (Myosotis scorpioides L.)

(See page 591)

The forget-me-not is a delightful immigrant belonging to that numerous family which includes the Virginia cowslip, hound's tongue, and comfrey.

The flowering season of this plant is from May to July. It came to us from Europe and Asia, and is now spreading from Nova Scotia southward along the Atlantic coast. It was led into captivity many centuries ago. As far back as we are able to trace flower history it held an honored place in the flower garden, and when America was settled, it was brought along to cheer the settler's austere life, and to remind him of the old roof-tree across the billowy sea.

The forget-me-not likes to play hookey from the flower garden, and to steal down to the brookside and meadow and live within earshot of the gurgling stream. With all that man has done for it, he has never bred out of it the spirit of independence that has been lost by most of the other flowers of the garden, for whenever opportunity affords, the forget-me-not yields to the call of the wild.

Have you ever noticed the little golden circle around the center of the flower? That little circle is put there by the flower as a honey guide, to tell the bee just where to insert her tongue to get the richest draught of nectar, and at the same time to touch both anther and stigma and thus fertilize the plant. And if you will watch the bees, you will discover that they are as careful to follow this signboard pointing to the well of nectar as a motoring tourist is to follow the signboard to the best hotel when night overtakes him.

There are many legends concerning the forget-me-not. Tennyson once wrote that it grows for happy lovers. Another writer tells us that once upon a time a young lover, trying to gather a bunch of these lovely blossoms for his sweetheart, slipped into the water and, as he was sinking, tossed the flowers to her and asked her to keep them and not to forget him.

VIRGINIA CREEPER (Parthenocissus quinquefolia (L.) Planchon)

(See page 592)

The Virginia creeper is a member of the grape family, cousin alike to the sour frost-grape of the woods and the luscious Concord of the vineyard. It has been called the false grape, although it is too fair a plant thus to be slandered by a name. No lover of the woodland will ever be made to believe that the Virginia creeper essays a rôle to which it is not entitled. Some people mistakenly call it the woodbine, but that name more properly belongs to another plant of the honeysuckle family.

Many people confuse the Virginia creeper with the rascally poison ivy, a confusion which nothing but carelessness in remembering the characteristics of plants could bring about; for the Virginia creeper is careful always to put forth five leaves where the poison ivy has only three (compare pages 592 and 593).

This graceful climber has traveled as far north as Newfoundland, as far south as Cuba, and as far west as the western part of the Mississippi Valley.

It lives true to its name, creeping on and on, securing a new foothold here and another there, sending out its tendrils as it grows. When one of these succeeds in arranging its branches so that they can press upon any surface, its curved tips swell and become bright red. On their undersides they form little disks or cushions, which attach themselves to the surface and afford a new foothold for the vine.

It is surprising how much weight one of these little disks can bear. Darwin tested their strength and found that one of them will stand a strain of two pounds, while five of them grouped together on a tendril can bear a weight of ten pounds.

What is more picturesque than the old-fashioned stone fence, or the stake-and-rider worm fence, with its load of green foliage in summer and its clusters of bright blue berries in the fall! Over fences, walls, and trees it rambles luxuriantly, and, while it seems to love its wild life best, it will gladly adopt one's very doorstep as its home, and welcome an opportunity to weave a curtain of living green over the sunny sides of the veranda.

In the autumn its blood-like sprays are outlined against the dark evergreens about which they twine, making a contrasting picture of rare beauty. The Virginia creeper has perhaps more honor abroad than at home, being widely cultivated in Europe. Even in Venice one may see it covering crumbling walls or gracefully clinging to carefully prepared trellises.

POISON OR THREE-LEAVED IVY (Toxicodendron radicans (L.) Kuntze)

(See page 593)

The poison ivy is a member of the sumac family, having as relatives the vinegar tree, the smooth sumac, and the smoke-bush. Its range reaches as far north as Nova Scotia, as far south as Florida and Texas, and as far west as Utah and British Columbia.

As described in the sketch of the Virginia creeper, it is often confused with that beautiful member of the clinging-vine clan. The Virginia creeper is condemned as being poison ivy oftener than poison ivy is accredited with being a Virginia creeper. Many a Virginia creeper has reached the untimely end of mattock execution by the error, and not a few people have received a painful reminder of their mistake when they have failed to observe that three leaves spell "foe" in the ivy vine and five leaves "friend."

The poison ivy, or poison oak, as some call it, is a prodigal climber, inclined to run over everything in sight. Even the oak sometimes is almost smothered when the poison ivy reaches its topmost branches and spreads its dense foliage over them.

It begins to blossom in May and June, its flowers being small, fragrant, yellowish green, and arranged in densely clustered spikes. Toward fall these develop into smooth, white, wax-like berries that often hold fast the winter through. The three leaves are shining green, short-stemmed, and oval-pointed.

The poison of this ivy is a powerful, nonvolatile oil which penetrates the pores of the human skin and develops hosts of tiny itching blisters, followed by a burning swelling of the affected parts.

While we very naturally dislike a plant that poisons us when we touch it, yet if we investigate the reason for its poison we discover that a vast number of plants develop poisons and near-poisons, and when we look over the list we find that we would be rather badly off without them. It is true that most of them are poisonous only when eaten, and that few are poisonous to the touch, but they have all developed these qualities in self-defense.

Some of them store their poison in their seeds, others in their root-stocks, and others in their roots to protect their progeny from harm. They do not go about looking for trouble or seeking, like the devil, whom they may destroy; but they are prepared to resist invasion of the rights of their children. Nux vomica and aconite are two of many such illustrations that might be cited.

Others develop alkaloids, like the nicotine of tobacco, the quinine of the cinchona tree, and the theine of tea, to protect themselves. Strychnine, digitalis, and a hundred and one indispensable drugs that are poisonous in overdoses are the gift of the plant world to man as a by-product of plant preparations for self-defense (see also gentian, page 589).

And so, when the poison ivy learned to give off its poison by contact rather than through its own destruction, it simply went a step further than its neighbors. It has arranged its plans of defense, so that it can wage war without first being eaten. In that respect it meets the problem in the same way as the thistle and the thorn, although it fights by subtle stealth rather than open warfare.

STEEPLE BUSH OR HARDHACK (Spiraea tomentosa L.)

(See page 594)

Close of kin to the meadow-sweet, the goat's beard, the ipecac, and the common rose, the hardhack, or steeple bush, is one of the most cheery of the pink and magenta flowers of the roadside, ditch, and swamp, blooming from July to September.

Living in territory where competition for insect favor is always fierce and the battle of the blossoms a lively one, the hardhack arrays itself in a remarkable cluster of delicate florets at the top of a two or three foot stem, which waves welcome in the swaying breezes to the insect hordes.

And that it receives its share of the business of bee and butterfly is evident to any one who will stop to count the shoppers who visit this floral department store. The bees and the butterflies are welcomed, but the plebeian ants are frowned down upon and given a chilly reception. Most of the hardhack's trade is in pollen, as its supply of nectar is somewhat limited, and as difficult to secure as are fast colors among us in these war times.

Being a dweller in damp soil, the hardhack has had to take precautions to protect itself from colds. If the under side of its leaves were not covered with woolly hairs, the vapors rising from the ground would clog their pores and interfere with their breathing. Behind the shelter of this smooth coat of vegetable fur

the steeple bush can resist changes in the weather and degrees of moisture that otherwise would be injurious, if not fatal.

Many other flowers wear their coats on the top of the leaves rather than underneath. They are usually flowers that grow out in the open and get the full benefit of the noonday sun; they would die of thirst if they did not have some way to check the process of transpiration when subjected to undue heat; hence this coat of fur.

The distribution of the hardhack is rather wide, reaching from Nova Scotia to Georgia and Kansas. It has so arranged its domestic economy that in the event the insects fail to bring it pollen from other flowers it can use its own for purposes of reproduction—a plan which it resorts to, however, only in a last desperate effort to insure itself against an unproductive life.

BUTTER-AND-EGGS OR YELLOW TOAD FLAX (Linaria vulgaris Hill)

(See page 595)

Butter-and-eggs is another flower that prefers to dwell in the open among men rather than in the forests among the trees. It inhabits waste lands, roadsides, and fallow fields, and blooms from June to October. It continues to add its orange and yellow color to the landscape until the frost comes upon the pumpkins and the fodder has been gathered into the shock. It is an immigrant, having come originally from Asia by way of Europe; but it has already spread from Nova Scotia to Nebraska and Virginia.

The butter-and-eggs is preeminently a bumblebee's flower. If other insects visit it, they have a very difficult time to persuade it to give them a sip of its nectar. The doors to its honey wells are always closed, and are so hinged that nothing but a heavy bee can push them open. The honey-bee is too light to operate them, and consequently it usually departs hungry.

When the bumblebee arrives at one of the butter-colored cornucopias holding the yolk of an egg, it alights on the lower lip of the flower, and its weight causes the door to fly open and the sign of welcome to be displayed. The bee enters, sticks its pump-like tongue down into the cup of nectar, and takes a draught. While it is doing this it is receiving in its turn a liberal dusting of pollen and depositing some of that which it received from the flower previously visited. Then it backs out, flies away to another blossom, while the door closes after the departing guest.

The butter-and-eggs has a hearty dislike for ants, and it has therefore built itself breastworks which can withstand every attack they make. It covers itself with bristly hairs, all pointing in the direction of possible invasion, and the ant armies that can successfully overcome this preparedness program are few and far between.

The plant has many qualities that protect it, among others the acridity of its juices. Housewives, in the days when everything was homemade, mixed its juices with milk, and the result was an excellent fly-poison. They also made an infusion from its leaves, which they administered to ailing chickens in the spring.

Butter-and-eggs has many aliases. In some localities it is called yellow toad flax, while elsewhere eggs-and-bacon, flaxweed, and gallwort are names used to designate it. It is a member of that numerous and prolific family, the figworts. Among its cousins are the mullens, the blue-eyed Marys, the monkey flower, and the foxglove.

COMMON MULLEN OR VELVET PLANT (Verbascum thapsus L.)

(See page 596)

The mullen is a distinguished member of the figwort family—a family that includes the butter-and-eggs, the monkey flower, blue toadflax, hairy beard-tongue, the Indian paint brush, and the wood betony.

The mullen is a lover of dry fields, banks, and stony waste lands. An old abandoned grass field is its particular preference, and it grows there in numbers that are very discouraging to the lad with a hoe who has been assigned to the task of waging a single-handed war of extermination against it. It flowers from July to September all over the northeastern part of America and in Europe and Asia as well.

Like many of its fellow-members of the figwort family, the mullen looks like something else. In some places it is called the taper flower, because its tall stalk seems a "taper tall" carried by the witches in the olden days. In other places it is called Aaron's rod, shepherd's club, and Jacob's staff.

The mullen has been with us in America so long that Europe has almost forgotten the fact that it is a native of that continent. Indeed, in the popular mind there it is a native of America. The Irish cultivate it in their flower gardens and call it the American velvet plant; but, in reality, it is an immigrant which has made itself decidedly at home on our shores. It came over as a stowaway, riding in the ballast, like many another weed that has developed the instincts of the globe-trotting hobo.

Indeed, one might trace the history of commerce by the weeds that grow along its pathways. Many plants won a footing on strange shores by riding in earth ballast in the old days, and in more modern times cattle were driven hundreds of miles to market, leaving the routes they took marked with weeds and plants more or less alien to those districts. Today railroads are active disseminators of alien vegetation, many a weed having been able to start colonies far and wide through that agency.

The mullen owes its name of velvet plant to the soft, velvety appearance of its leaves. Being forced to endure intense heat in summer by reason of its preference for an open situa-

tion on a sunny hillside, it needs some check to keep it from transpiring too freely; and being under the necessity of enduring intense cold in the winter by reason of the open, unprotected situations in which it finds itself when in the year old rosette stage, it has had to find something in the clothing line capable of acting as a sunshade in summer and an overcoat in winter.

If you examine this sunshade or overcoat—depending whether you study the plant in summer or winter—you will find it made of many minute and interlacing hairs which are equally efficient in keeping out the cold and heat.

This velvety coat has its romantic as well as its commonplace uses. We are told that rural maidens rub their cheeks with it and thus produce that peach-blossom effect that the best rouge and enamel can never give them; and also it is said that humming-birds gather the downy velvet from the leaves to make their nests.

The mullen has had many uses. The Romans dipped the stalk into tallow and used it as a funeral torch. In the Middle Ages it was used as a candle-wick by many people. It is reputed to have medicinal virtues for both man and beast, smoking dry mullen leaves and drinking mullen tea being resorted to by those having colds. It won, in England, by reason of its reputation as a healer of cattle diseases, the name of "bullock's lungwort."

SWAMP ROSE-MALLOW (Hibiscus moscheutos L.)

(See page 597)

The swamp rose-mallow is one of the largest and most gorgeous of all indigenous American flowering plants. Growing to a height of 3 to 8 feet and having a flower from 4 to 8 inches in diameter, it is a marked feature of any landscape it undertakes to adorn. Its flowering season is in August and September, and it occurs as far north as Massachusetts and as far south as the Gulf of Mexico.

It is one of that vast group of wild flowers that are truly wild, preferring to remain away from the haunts of man rather than to come out and force him to cultivate it by stealing a place among his crop plants. Rather, as if to be of service to humanity by adding its touch of beauty to spots that otherwise would be ugly, it seems to prefer brackish swamps, unkempt river banks, and unattractive stretches of lake shore.

But while it is one of the truly wild flowers, it submits without protest to domestication and very peacefully takes its place in the flower garden alongside the hollyhock, which, by the way, is its distant cousin.

It has many other cousins, some more remote and some closer than the hollyhock. The velvet-leaf mallow came from India as a cultivated flower, but so attractive was the call of the wild to it that now it belongs in the category of "escapes"; for whenever a domesticated species runs away and gets a footing of its own it is written down by the botanist as an "escape."

And it is surprising how many of the flowers we see in the field and forest have thus seemed to resent the idea that they cannot live except under cultivation. We have bred the ability to set seed almost entirely out of sugar-cane; we have practically bred the seeds out of the banana and the orange; we have so cultivated our corn and wheat and most of our garden crops that they are wholly unable to shift for themselves any longer.

But, on the other hand, there are hundreds of plants that, despite long generations of coddling, still retain enough of vitality and self-reliance not only to shift for themselves when they have to, but even to seek the chance of doing so.

The mallow is a cousin of the cotton plant, the cotton fiber being nothing less than the woolly hairs with which that plant surrounds its seeds.

Many people confound the rose-mallow with the marsh-mallow. It is indeed a marsh mallow, growing in marshy ground; but it is not *the* marsh-mallow. That mallow has a small pink flower and is an alien brought to our shores; yet it is a true American in its spirit of being useful. It is from this mallow's roots that the tasty mucilage comes which we call "marshmallow" in the commercial world.

Still another cousin of the swamp rose-mallow is the gumbo, or okra plant, so popular in the Southern vegetable garden and figuring so much in the culinary operations of the kitchen.

The mallows can point with pride to a long lineage of useful service to mankind. Even as far back as the days of Job, many wandering tribes cut up mallows and juniper roots for meat, and the Romans had a mallow which they served as a vegetable. The ancients considered the mallow a powerful medicinal herb; Pliny records this high regard by declaring that whoever eats a spoonful of mallows "shall that day be free from all the diseases that come unto him."

SPOTTED BONESET OR SPOTTED JOE-PYE WEED (Eupatorium maculatum L.)

(See page 598)

Spotted joe-pye weed is a member of the thistle family and has many aliases. In some places it masquerades as trumpetweed; elsewhere it travels under the name of thoroughwort, while in still other localities it passes as cottonweed.

First of all, spotted joe-pye asks for a moist soil. Given that, it will live either in meadow or in wood. It is a rather late-comer in the flower procession, August to September being its months. As a habitat it claims all of that portion of North America between New Brunswick and Manitoba on the north to the Gulf of Mexico and the Rio Grande on the south.

Spotted joe-pye marches through the world with head held high, having long since learned that in the flowery kingdom, as well as in the business world, it pays to advertise. Therefore

it erects a sort of Metropolitan Tower in flower land, decked with a beautiful and wonderful collection of magenta flags. Of course, no insect could miss it, and during its business season it has a host of visitors, to each of whom it offers a cup of nectar in return for a little service as a pollen-carrier.

A clever arrangement has been worked out by the spotted joe-pye weed, whereby, if there happens to be a rainy spell and the insects are not flying when it blooms, it can fertilize its own florets, and thus protect itself against the evils of race suicide in flower land.

The spotted joe-pye weed derives its name from Joe Pye, an Indian herb doctor of Pilgrim days in Massachusetts. It is claimed that he cured typhus fever with decoctions he made from this weed. It is also claimed that with it he set shaking bones to rest in ague-rent bodies; hence its name "spotted boneset."

CHICORY OR BLUE SAILORS (Cichorium intybus L.)

(See page 599)

Chicory, otherwise known as "blue sailor" or "bunk," is an alien which came to our shores "riding the bumpers," so to speak. In the olden times, when ships carried earthen ballast, many a European weed got free transportation to America. It now flowers in Canada and the eastern United States as far south as the Carolinas; and in recent years it has pushed its star of empire westward, until it includes Nebraska in its American dominions.

It is a plant that loves to dwell around the haunts of men, and never wanders very far away from them; hence the roadside and the fallow field are its favorite dwelling places. It begins to flower in July, and is one of the last to pass of that myriad throng which comes while springtime snow-banks still linger, and goes only when the biting frosts of autumn come to stay.

Chicory has long been one of the wild flowers of immediate and important use to man. The Belgians, for instance, even in the years before the great war, their incomes being too slender to justify the drinking of coffee, resorted to the chicory as a substitute; and in the days before our own pure-food laws were enacted it became such a generally used adulterant that even the adulterant came to be adulterated.

Many a pound of what purported to be roasted chicory was perhaps half chicory and half roasted wheat or barley. In a single year we have imported nearly 7,000,000 pounds of chicory root. Even under the conditions prevailing just before the outbreak of the present war we were importing about 2,250,000 pounds annually. Some people claim that chicory added to coffee imparts a flavor which makes it better than coffee in its pure state.

In Europe chicory itself is very widely used as a pot herb. The French force it and blanch it, much after our way of forcing and blanching celery, and make of it a salad which they call *barbe de capucin*.

Homer used chicory root as a part of his frugal fare, and Pliny tells us that it was one of the staple dishes of the Egyptians.

There are many denizens of the plant world close of kin to the chicory. One of these is the dandelion and another is the endive.

Somebody has said that the chicory is a peasant posy, which, opening its eyes on a cloudy day, sets its pale-blue flowers abloom, one after the other, as sparingly as the lights are kindled in the candelabra of decaying palaces. To insure its reproduction, it never allows all of its flowers to come into bloom at once. By having them bloom in installments, it is sure at one time or another to have insect visitors that will fulfill its plans.

Chicory is very methodical in its ways, keeping regular hours and being one of the leading exponents of the idea that "early to bed and early to rise" works as well in the flower kingdom as among men. It generally awakens by 5 o'clock in the morning and shuts its eyes again at 10 a. m.; but during that time it has entertained some of the most delightful insect visitors that are to be found in any community. So regular is the chicory in its habits that the Swedish naturalist, Linnæus, used it as one of the flowers of his floral clock.

BUTTON BUSH (Cephalanthus occidentalis L.)

(See page 600)

The button bush is a member of the madder family, having among its relatives the dainty bluet, the fragrant partridge berry, the ride-stealing beggar's lice, and the aromatic-berry-producing coffee-tree.

One of the first traits we notice about the button bush is its constant endeavor to keep away from mankind. Knowing that the swamp is about the safest place from human incursions that it can find, it goes there and dwells in enviable isolation.

We are prone to be selfish enough to think that the flowers' beauty and fragrance were created for our especial pleasure and edification; and yet a study of nature's flower garden reveals the fact that some of the most fragrant of the blossoms of summer shed their sweetness and pour forth their beauty in precincts far removed from man's accustomed haunts.

One of these is the button bush. With an odor as seductive as that of jasmine, it could win its way into the hearts and homes of humanity if it desired to do so; but it has no inclinations in that direction, although, like the swamp-rose mallow, when led captive it submits gracefully and grows even more attractive than before.

Its closely packed host of florets, hundreds in number, with their long styles and capitate stigmas, making it resemble a well-filled pincushion, do not remain fresh long after plucking.

The flowering season of the button bush begins in June and ends with September, and its range is from New Brunswick to Cuba and

California. It is a shrub, and grows to a height varying from 3 to 12 feet.

The button bush relies more on its appeal to the nose than to the eye of the insect world, having discovered that most insects can smell further than they can see. Only a comparatively few flowers have learned this to as full an extent as the button bush. It is said by naturalists that in New York State, which has rather a wide range of plant species, borrowing both from the northern and southern flora, there are only about thirty really fragrant species to be found.

The result of the button bush's fragrance is that, in spite of any lack of gorgeousness its flowers may show, it always has a liberal share of the nectar drinkers of the insect world. Every "pin in the cushion" has its own individual honey well, and these are so deep that a short-tongued bee or butterfly never succeeds in drinking one dry. Butterflies come first among its visitors, and after them honey-bees and bumble-bees, though wasps and carpenter bees also seek a chance cup of nectar now and then.

The button ball has learned in the hard school of experience that there is degeneracy in self-fertilization, and has therefore so shaped its household economy that self-fertilization cannot take place. The power to produce pollen is lost by its anthers before the power to receive it is developed by its stigmas. Thus the pollen produced by a given set of anthers is not available for their companion stigmas, but must be transferred to those of some other flower.

In many flowers self-fertilization is prevented by the maturing of anthers and stigma at different times, just as is the case in the button bush; others have the stamens curved outward and away from the stigma. Still others have found still other ways equally ingenious and equally effective for the same end (see also fringed gentian, below).

And so it is that we see flowers ascending the scale of existence, ever laboring to improve their race, ever striving for a higher and better existence, ever seeking so to live and so to act that they will be able to bequeath to their posterity strength and fitness to survive.

Through the centuries fate goes on and on weeding out the unfit in flower land and teaching its inhabitants that the path to excellence is the only sure road to survival.

FRINGED GENTIAN (Gentiana crinita Froelich)

(See page 601)

The fringed gentian lives in low, moist meadows and woods, and begins to blossom when most of its fellows of the flowery kingdom have gone to seed and to death. One meets the fringed gentian from Quebec to Georgia, and as far West as the region beyond the Mississippi River.

When this handsome but late comer arrives even the birds have nearly all flown and their songs are only a memory, while the color of autumn is largely that of leaves which have arrayed themselves in the bright-hued garments in which they bid their parent trees farewell. It seems, indeed, that the poet was right who wrote that the fringed gentian comes with its merry blue to cheer the melancholy days that portend the passing year.

In order to insure the production of a full supply of fertile seeds, it has adopted methods insuring it against self-fertilization. The stamens mature and lose their power to fertilize before the pistils are developed, and it thus saves itself from that harmful inbreeding to which only flowers low down in the scale of floral existence resort (see also button bush, page 588).

The fringe of the gentian adds grace to it, but that was not the flower's thought in providing the fringe, for even the most lovely of flowers is utilitarian in its instincts. The ants long generations since developed a fondness for the nectar of the gentian; great hordes of them overran it and drained its nectar cups. But, since the flower had taken precautions to insure cross-fertilization, it could not afford to have the ants pilfer the nectar which was the currency with which it rewarded the bees and butterflies for their assistance in its new plan of fertilization. Therefore, like the butter-and-eggs (see page 586), espousing the cause of preparedness, it developed a system of defenses against ant invasions that is remarkable alike for its thoroughness and its beauty.

There are many kinds of preparedness in the plant world other than that used by the fringed gentian and the butter-and-eggs. Some plants secrete a milky juice which exudes whenever the plant is injured and which usually covers the invader with a touch of raw india-rubber. Others secrete resins, such as turpentine. Others supply themselves with a defense of tannic acid, while still others manufacture poisons, or have strong scents, like lavender and mint, or spines like thistles, or thorns like roses (see also poison ivy, page 585).

Some even go so far as to make friends with certain kinds of fierce ants, which keep the leaf-cutters away, as in the case of the South American acacia. The latter employs a species of police, or a standing army, of ants to keep off injurious insects or larger animals. The plant has hollow thorns, and upon the tips of its leaflets there are small projections full of sugary material. The hollow spines are inhabited by colonies of fierce soldier ants, which swarm out and drive off any insect enemy. They are fed, or "boarded," on these sweetish projections.

BUTTERFLY-WEED (Asclepias tuberosa L.)

(See page 602)

This hardy American, like many another wild flower, has no taste for the solitude of woods and marshes. Rather, it prefers to add its touch of color to the roadside, the dry or sandy field, and the hills. It loves to watch the world

go by and to cheer the passing throng with its brilliant orange-red flowers, its green leaves, and red stalk.

Nor is the butterfly-weed stingy with its favors, for June finds it decking itself with its splendid array of flowers; and only in September does it doff its georgeous colors.

The butterfly-weed sweeps in stately grandeur from Maine and Ontario to Arizona and the Gulf of Mexico.

Weed it may be to us, but sweetest inhabitant of nature's flower garden it is to the myriads of butterflies, for whom it is indeed a "land flowing with milk and honey." The high and the low, the rich and the poor, the great and the small—prince, noble, and pauper alike—come to its table. Here is the exquisite half-moon-winged swallow-tail, touching elbows, as it were, with the scrubby little cabbage butterfly, and the elegantly attired spice-bush swallow-tail sipping from a cup next to the one which the little old mud-puddle "yaller" butterfly is draining.

This flower, like its kinsfolk of the milkweed family, has a marvelous mechanism for forcing its guests to pay well for their board.

The alighting place where these animated aëros effect their landings is decidedly smooth and slippery, and the arriving guest finds himself on a surface which makes a newly waxed ball-room floor seem like a stony pathway in comparison. As he does a combination of the tango, the fox trot, and the jig trying to find a stable footing, one foot, or mayhap two, slips into a little slot, which holds fast. While wriggling around to get loose, his foot slips down farther into the slot. A sharp jerk releases the foot, if the insect is strong enough, but not until a little pair of pollen saddle-bags has been bound to it. Bumblebees sometimes get away from a plant with half a dozen of these little saddle-bags hanging to their legs.

At the Centennial Exposition at Philadelphia, in 1876, a bed of beautiful flowers brought over from Holland won the admiration of many thousands of people; and yet they were only a Dutch edition of our own butterfly-weed.

The Indians used the butterfly-weed's root in treating pleurisy, and made a crude sugar from its flowers. They used the young seed pods in the cooking of buffalo meat much as we might use green peppers with chicken or hash.

JACK-IN-THE-PULPIT (Arisaema triphyllum (L.) Torr.)

(See page 603)

Jack-in-the-pulpit is one of the denizens of flowerland that seldom ventures out of the forest. It loves wet, marshy ground, blossoms from April to June, and claims as its own all of that vast territory from Nova Scotia westward to Minnesota and southward to the Gulf of Mexico.

Jack is a member of a numerous family, among its relations being the stately calla lily, loved by all who appreciate beauty and grace, and that black sheep of flowerland, the skunk cabbage.

What country boy has not been tempted into tasting of "Indian turnip root," to his sorrow and to the great burning of his mouth? And why should he not suffer, for that root which has been ruthlessly torn up represents the hard-earned savings of Jack-in-the-pulpit. During the happy days of the summer-time Jack labors hard to pay the premium on his life insurance, so that in the spring to follow, when he is dead and gone, his heirs may rise up possessed of a "grub-stake" that will provender them until they can win their own place in the world. Many plants thus insure their lives in behalf of their posterity, giving every bit of their surplus income over to a root-stock fund for their children.

Jack-in-the-pulpit got his name through the resemblance of the little hooded house of green which he builds to the old-time pulpits, which had a sort of hood over them.

He received his name of "Indian turnip root" through the fact that the Indians habitually raided his root-stock insurance, and, boiling the "bite" out of it, made of it what they considered a delectable dish.

Another cousin of Jack's, as stated before, is the skunk cabbage, which has the painful habit of smelling bad; and yet there is method in its madness, for it is an insectivorous flower. It tries to simulate the odor of decaying meat in order that all of the flies, the big blue-bottle ones and all their neighbors, may be attracted its way. As soon as it gets them, it lays hold of them, and makes a feast of them instead of for them. It is strange that a family with such a noble head as the calla lily could possess a sheep so black as the skunk cabbage, and it is equally strange that the floral procession of the year should be headed by this evil-smelling representative of the flowery kingdom.

Jack-in-the-pulpit is gradually copying the ways of the most disreputable member of his family, instead of trying to live up to the beautiful reputation of his fair cousin the calla. He has so arranged his pulpit that once a tiny fly or ant or bee gets in, it has mightly little chance to escape. A bear was never more firmly held by the jaws of a big steel trap than are the bees in the little green trap which Jack sets.

YARROW OR MILFOIL (Achillea millefolium L.)

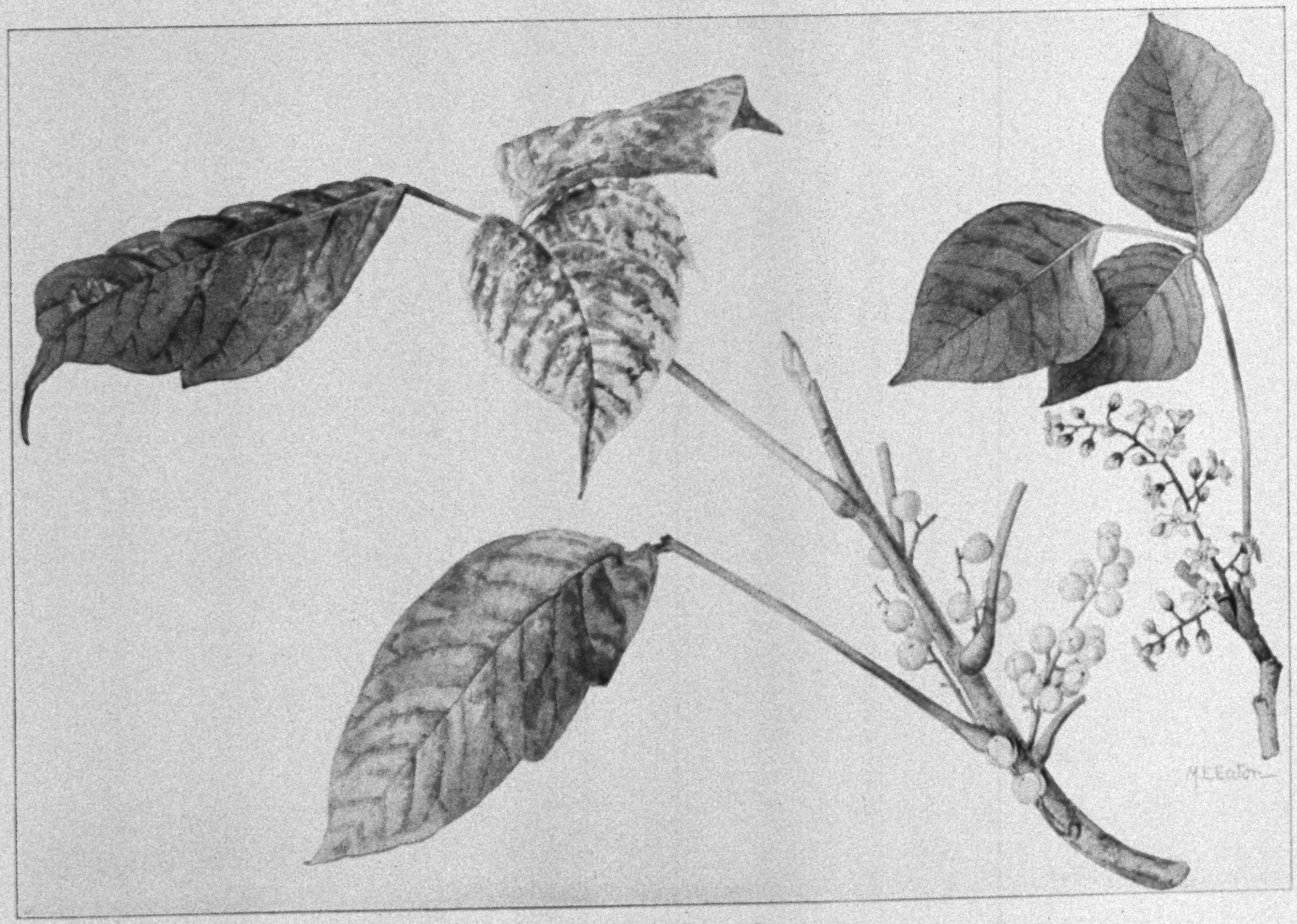
(See page 604)

The yarrow is a member of the thistle family, though it defends itself from the attacks of grazing animals by its odor rather than by pricking spines. It is true that it has incipient spines in the shape of bristly hairs, but these are not stiff enough to do any damage.

Yarrow has as many different names as a modern Raffles. Some call it milfoil, crediting it with having a thousand leaves, just as rural folk credit a centipede with being a thousand-leg worm. Others call it "old man's pepper," by reason of its spicy aroma, and others nosebleed, by reason of its nosebleed-producing qualities. Still others call it soldierwort, by

FORGET-ME-NOT
Myosotis scorpioides L.
591

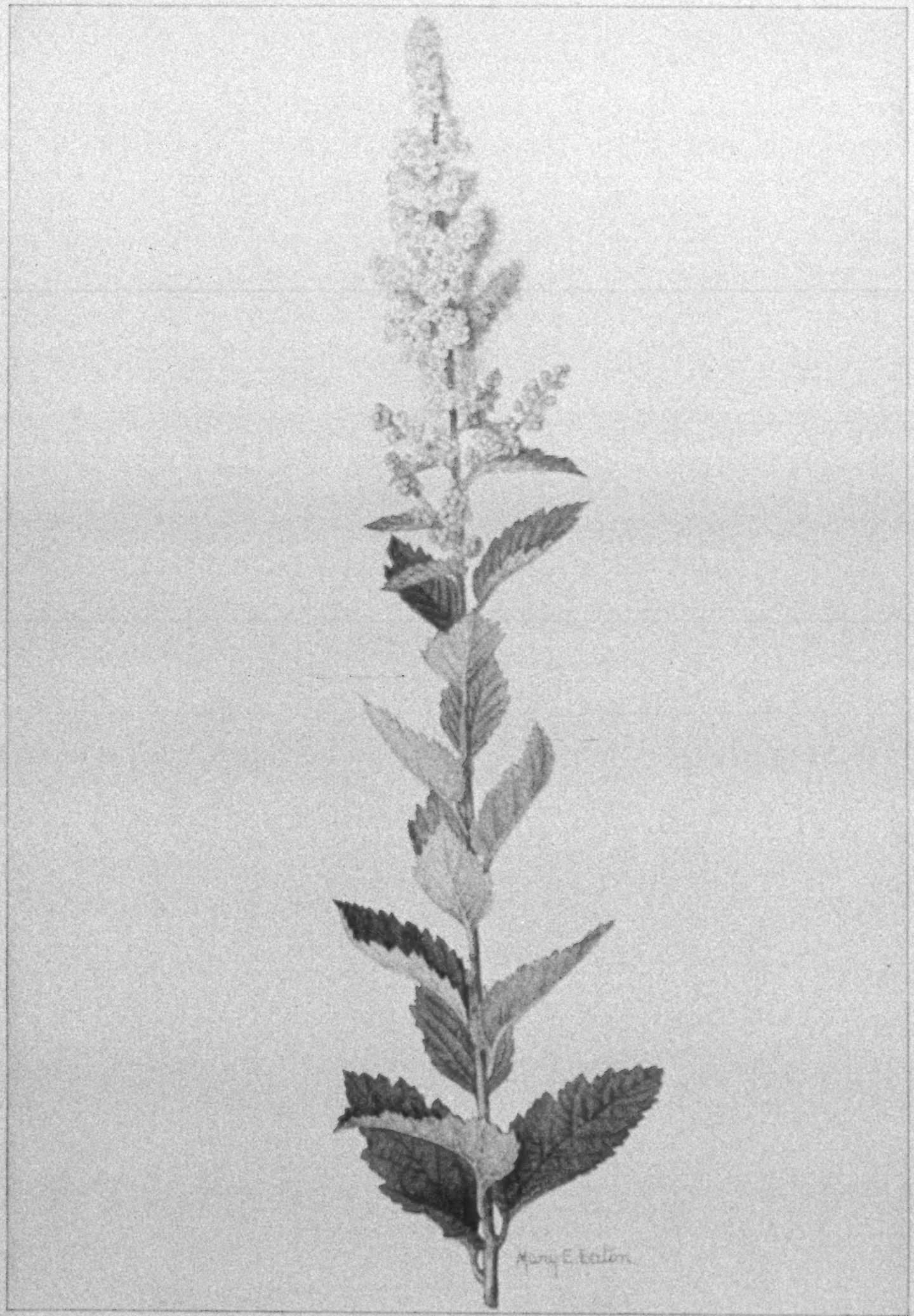
VIRGINIA CREEPER
Parthenocissus quinquefolia (L.) Planchon
Contrast it with the dangerous Poison Ivy on the next page



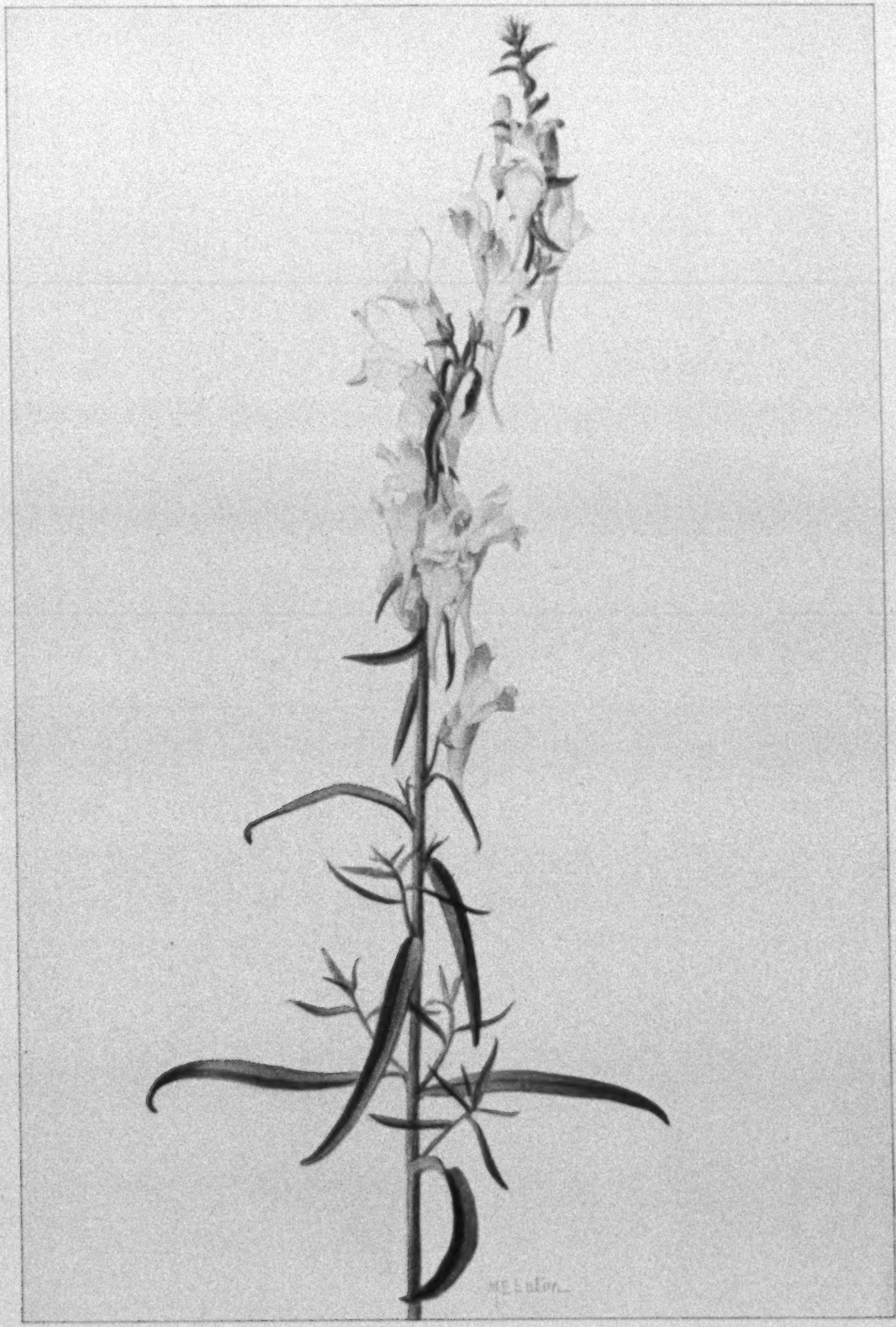
Poison or Three-Leaved Ivy

Toxicodendron radicans (L.) Kuntze

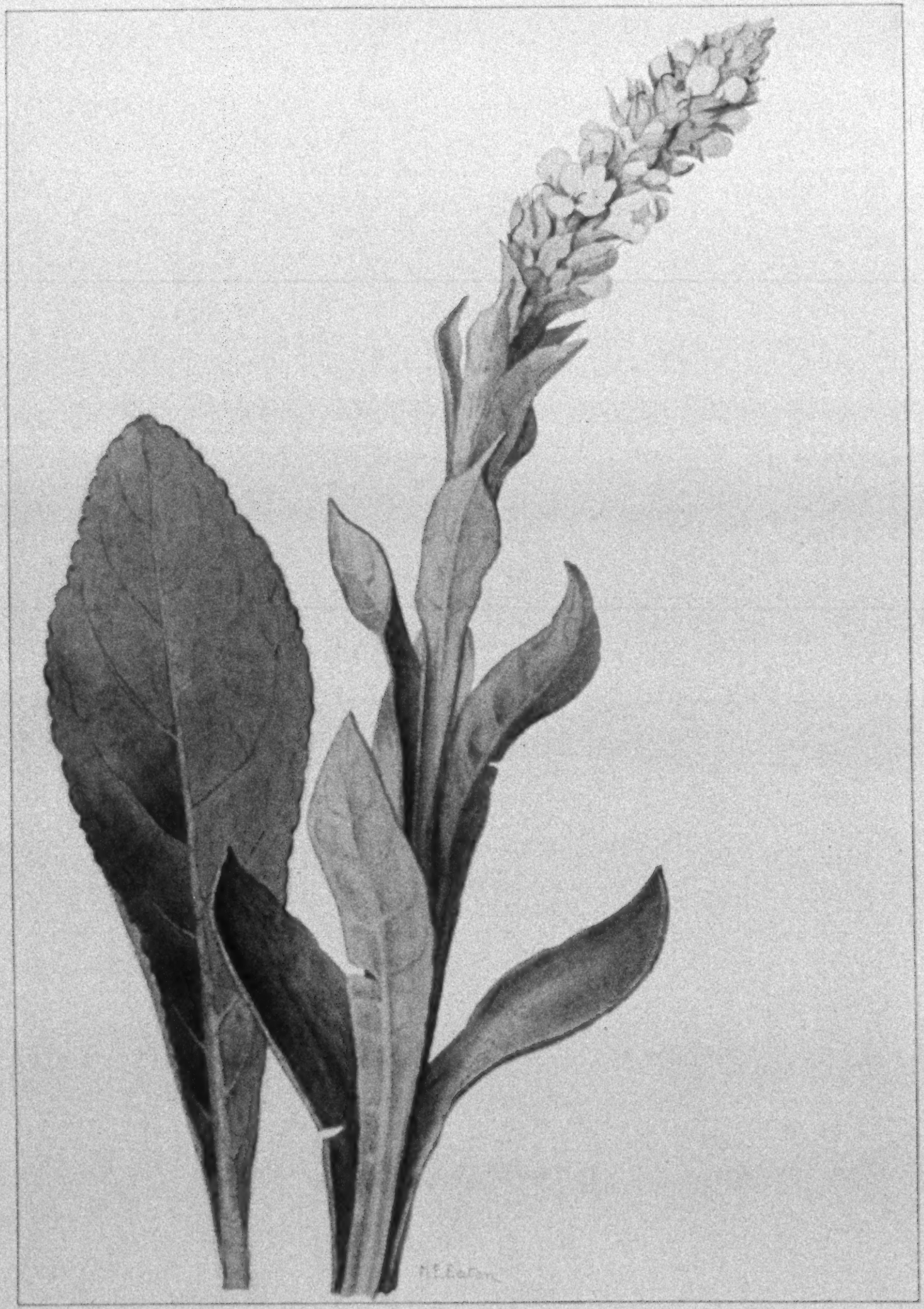
Contrast it with the harmless Virginia Creeper on preceding page



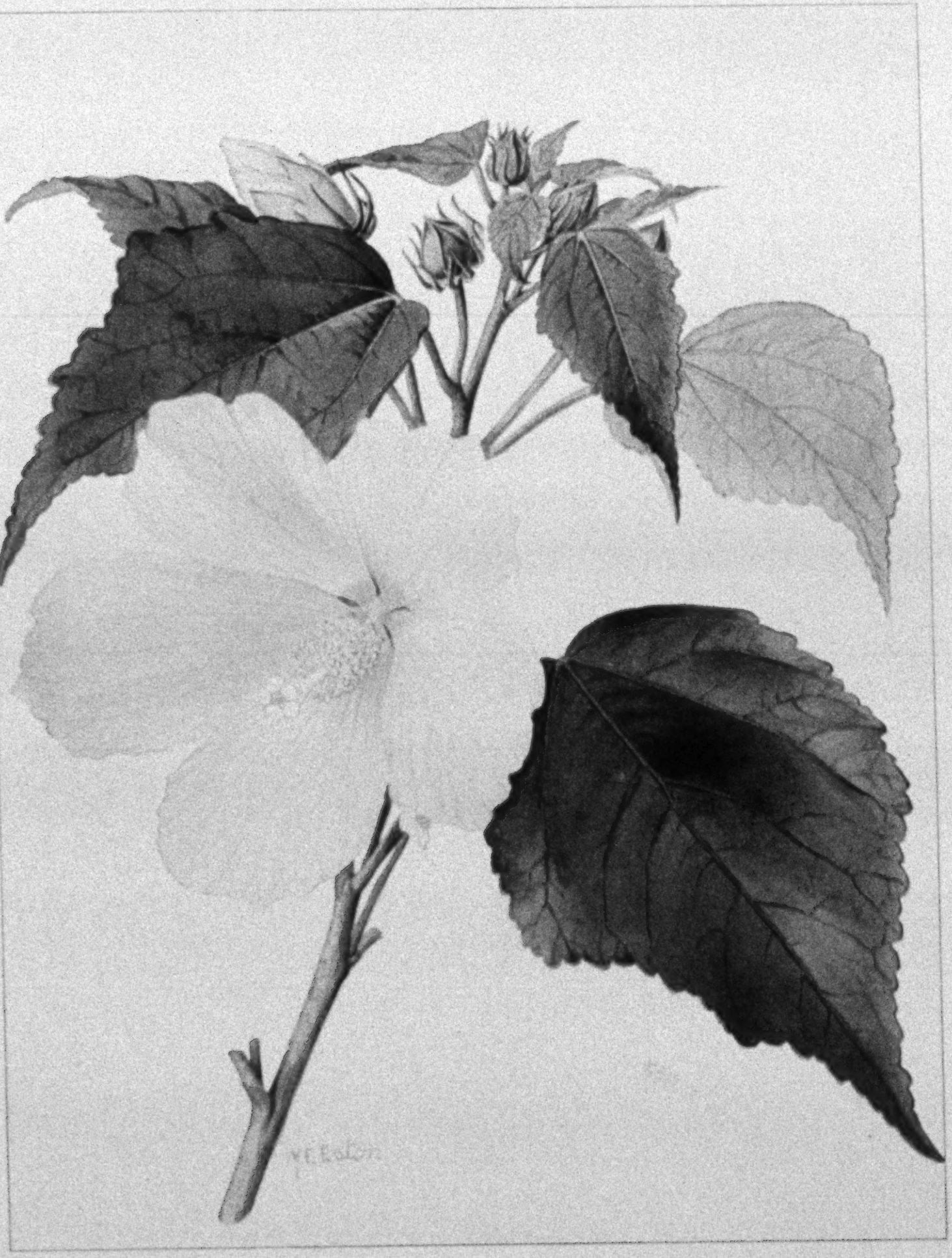
Steeple Bush or Hardhack
Spiraea tomentosa L.



Butter-and-Eggs or Yellow Toad Flax
Linaria vulgaris Hill
595



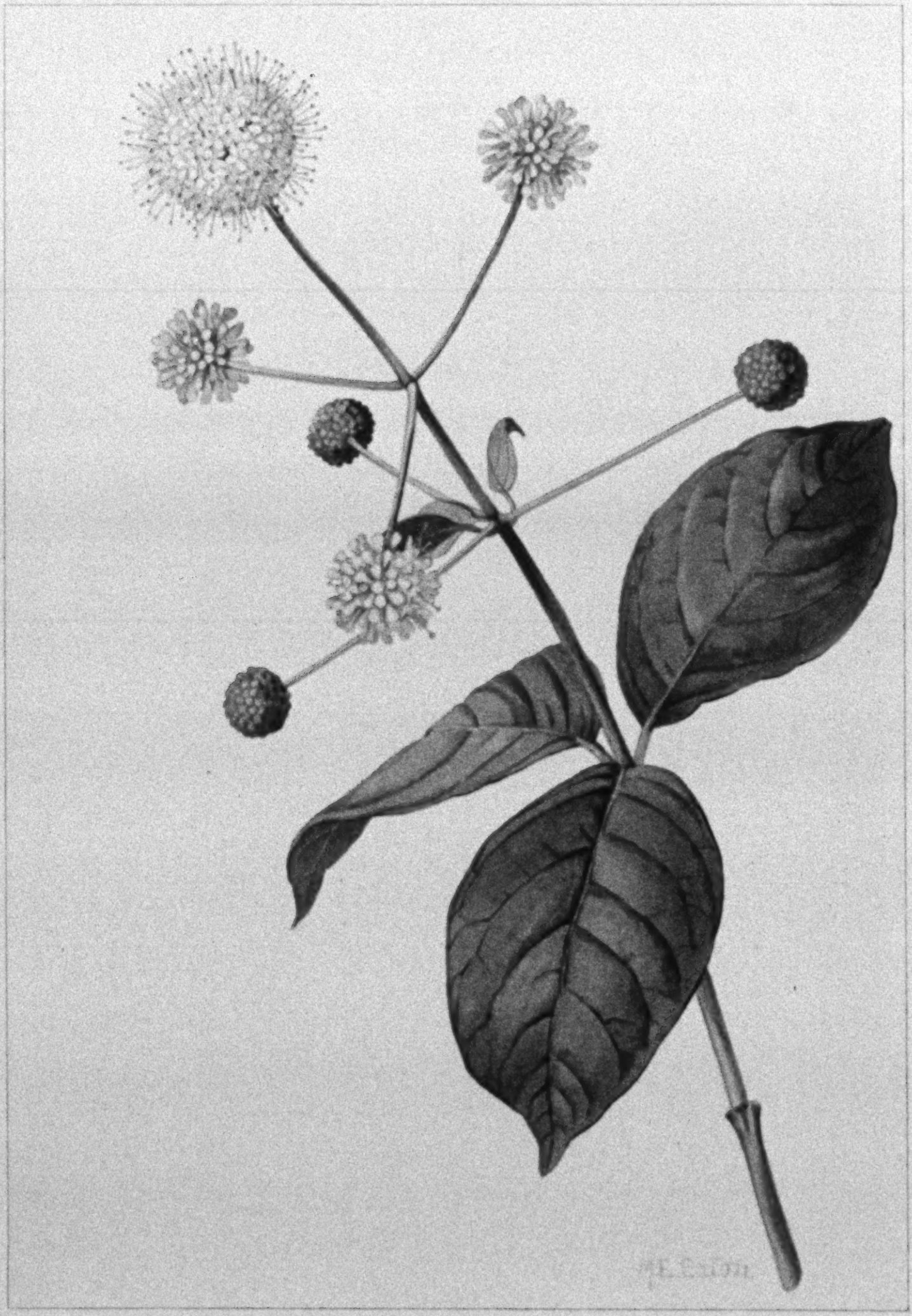
COMMON MULLEN OR VELVET PLANT
Verbascum thapsus L.
596



SWAMP ROSE-MALLOW
Hibiscus moscheutos L.
597

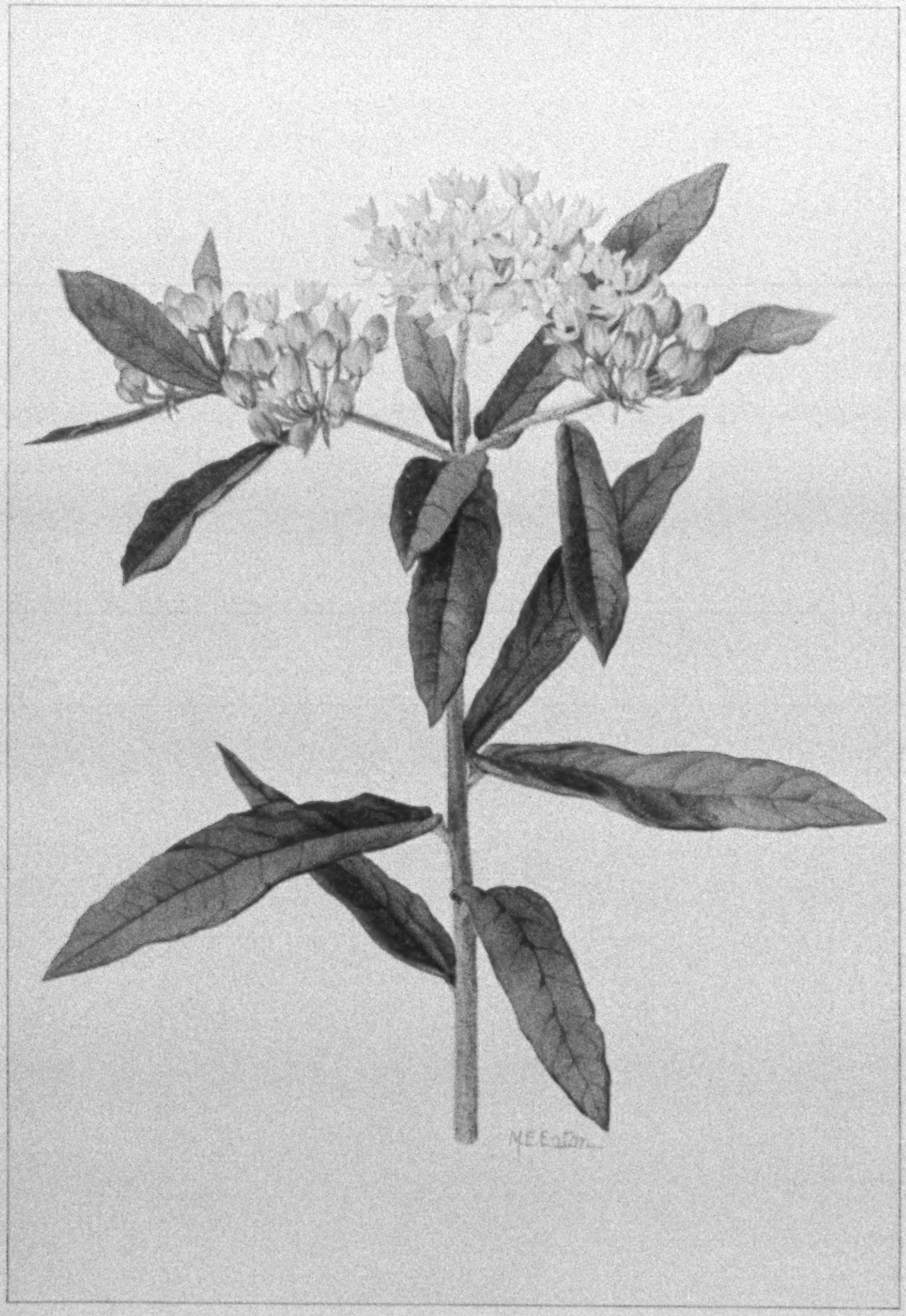
Spotted Boneset or Spotted Joe-Pye Weed
Eupatorium maculatum L.

CHICORY OR BLUE SAILORS
Cichorium intybus L.
599

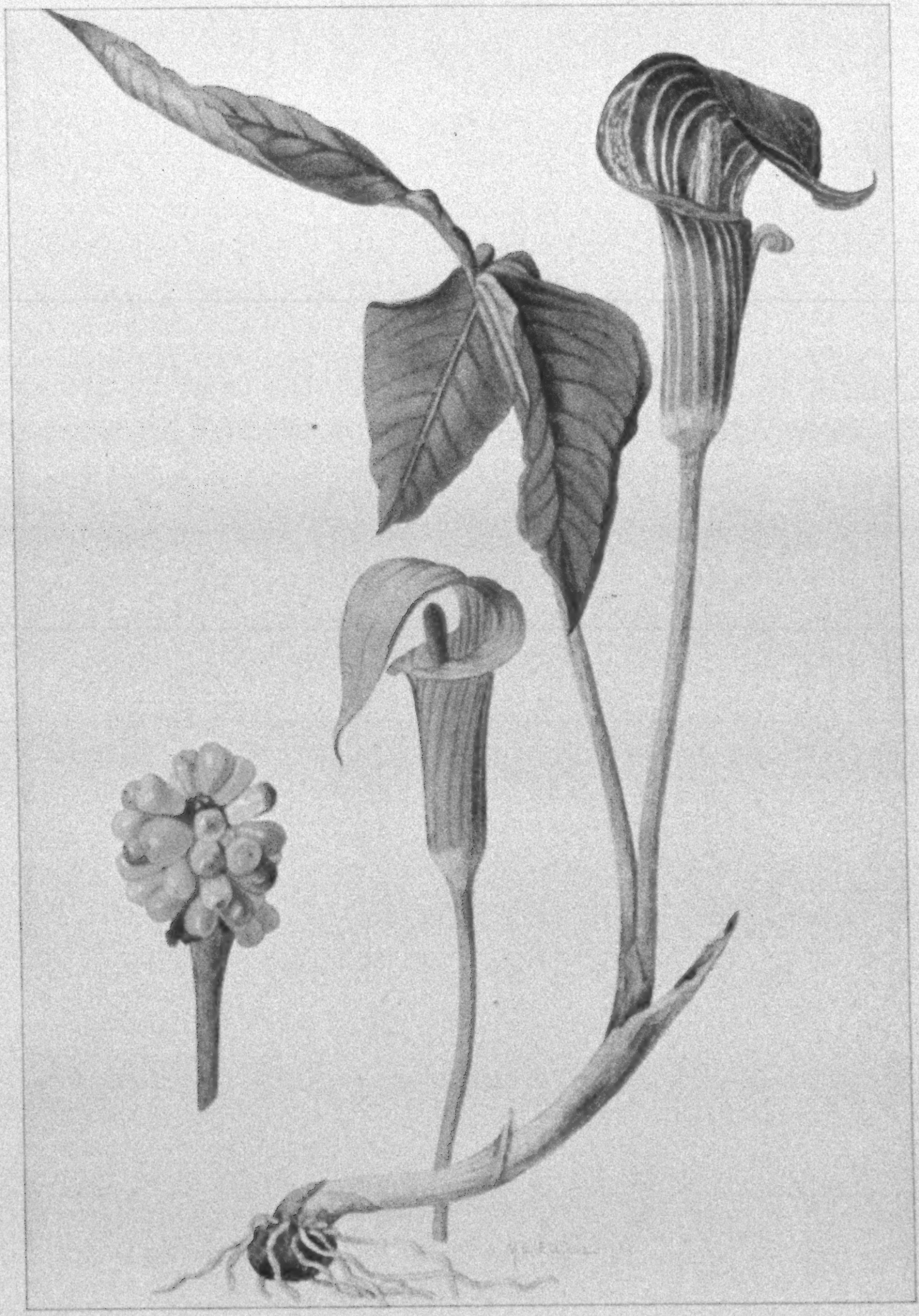


BUTTON BUSH
Cephalanthus occidentalis L.
600

FRINGED GENTIAN
Gentiana crinita Froelich
601



Butterfly Weed
Asclepias tuberosa L.

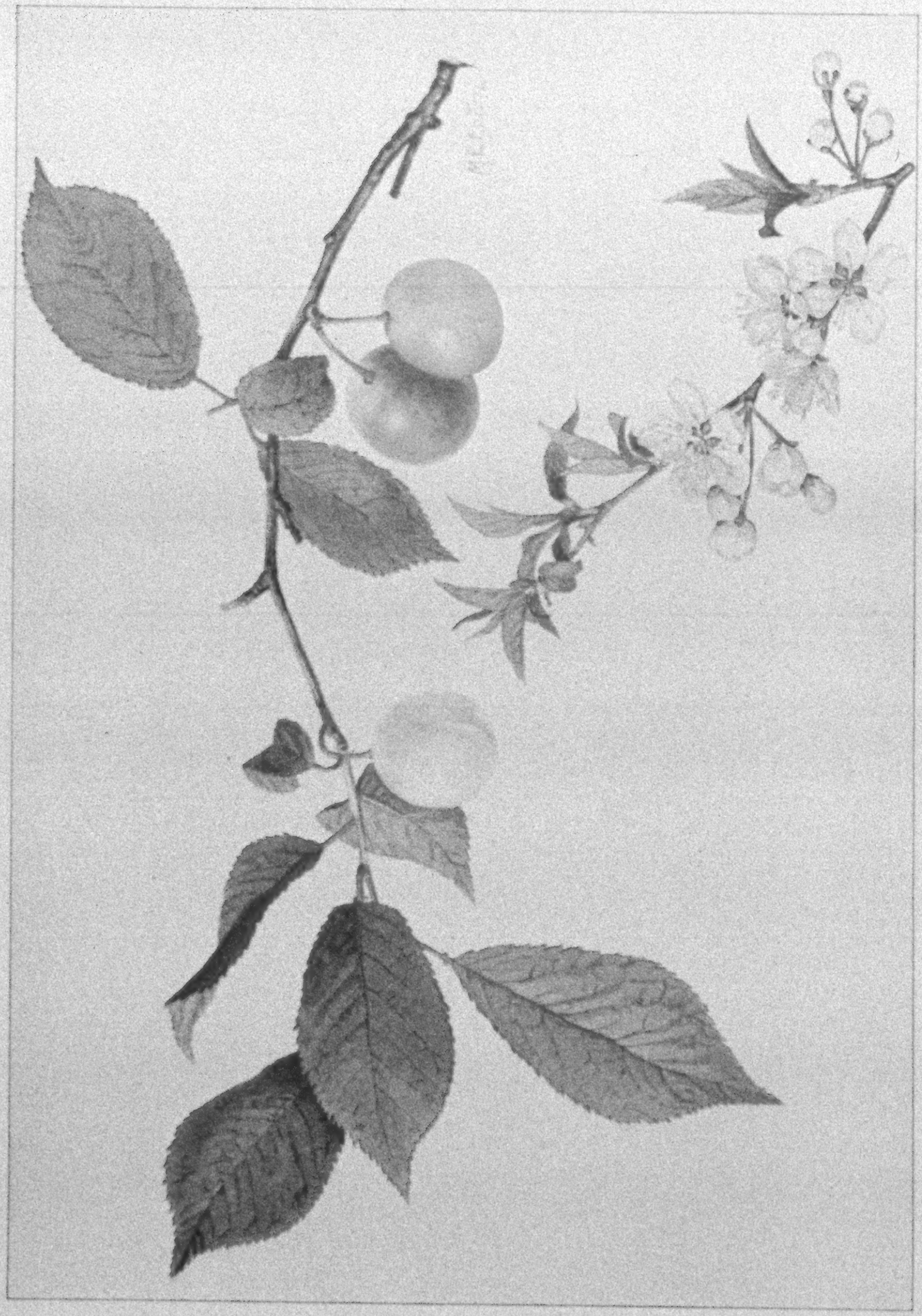


JACK-IN-THE-PULPIT
Arisaema triphyllum (L.) Torr.
603

YARROW OR MILFOIL
Achillea millefolium L.

FIRE WEED OR GREAT WILLOW-HERB
Chamaenerion angustifolium (L.) Scopoli

New England Aster
Aster novae-angliae L.
605



Wild Yellow or Red Plum
Prunus americana Marsh.

reason of its efficacy as a homely remedy in the treatment of wounds.

It derives its official Latin name from the Greek warrior Achilles. We are told that Chiron, the centaur, taught its virtues to the defender of ancient Troy, who made from it an ointment with which to heal his wounded myrmidons.

The yarrow is widely used in the remote rural districts as a love charm. A girl wraps it in flannel and puts it under her pillow, repeating a verse. The next day she puts it into her shoe and asks it to guide her footsteps to her future husband. The first single man she meets is supposed to be the one it recommends to her.

When is a plant a flower and when a weed is a question that often has been asked. Some one has called a weed a vegetable vagabond which adds to the vice of idleness the good-for-nothing trait of mischievousness.

The yarrow is a charming flower to some. To the city-born it is an exquisite, lacy flower, so much so that it is sometimes cultivated. In the Azores it is cultivated as the lace plant, and one writer reports having seen it growing on the lawn of an exclusive home on Fifth avenue, New York. But to the farmer whose hay-fields it invades, and to his sturdy sons who must work many a hot summer day to keep it from running away with the farm, it loses all its poetry and romance and grace and becomes a living sign of a poor farmer—a weed of the worst type.

When one considers how the yarrow chooses the grass fields as its favorite habitat and makes the farmer help to propagate it by cutting it with his hay, and thus scattering its seeds far and wide, he cannot but reflect upon the wonderful determination with which it fights extermination.

Indeed, the more "pestiferous" a weed is to a farmer, the greater have been its achievements in the way of overcoming obstacles. One would admire greatly their gameness, their generalship, and their spirit of "facing their fortunes like a man" were not their triumphs the farmer's defeats.

Take purslane, lambs quarter, and a dozen other weeds. They need cultivation to thrive well, so they steal into garden and truck patch and compel the gardener to cultivate them while he cultivates his vegetables.

Then there is corn cockle, "croutweed," garlic, and innumerable other weeds which like nothing better than to get into a wheat-field and get cut along with the wheat. The farmer must thresh them with his wheat, and thus they get sown in well-prepared soil once again.

Nearly all the weeds have learned to fit themselves to those farm operations which are best suited for their spread. That is the reason that yarrow gets such a firm hold wherever it goes. The farmer cannot "make hay" without "making yarrow," too.

The insect world likes the yarrow if the farming population does not. More than 120 species of bees and butterflies visited a watched plant in a single day. Its nectar stands seem as popular in insectdom as the pink lemonade stand at a circus or a soda fountain at a corner drug store on a hot day.

GREAT WILLOW-HERB OR FIREWEED (Chamaenerion angustifolium (L.) Scopoli)

(See page 604)

Nature appears to detest ugliness as much as she abhors a vacuum, and seems to have created the fireweed as an antidote for one of the ugliest sights a landscape may offer—burnt-over ground; for it is first and foremost among the flowers to labor for the blotting out of these inkspots upon the carpet of the earth.

The fireweed deserves its name, for it seems to be a real Phœnix among the flowers, rising out of the ashes in green and pink robes as though the flames had been its friends.

It takes to the fallow field and the dry roadside when it cannot find a burnt district to cover, and begins to blossom with the coming of June, and only with the passing of September joins the somber host that marches to its doom when Jack Frost turns executioner with the cutting cold as his ax.

A genuine cosmopolite is this "first aid" to burnt-over Nature, for it is not only at home in America from the Atlantic to the Pacific and from Canada to the Carolinas, but also in Europe and in Asia. It belongs to that extensive family of which the evening primrose is the name-giving member, and of which the primrose willow, the long-stemmed sundrop, the fuschia, and the enchanter's nightshade are distinguished representatives.

The scheme by which the fireweed saves itself from the evil of self-fertilization is the same as is used by the button bush (see page 588), the holding back of the styles from maturity until such time as the pollen from the flower's own anthers is gone. As soon as that happens the down-curving styles bend upward, so that no bee or butterfly that has come to them from another flower can get a single sip of nectar without first giving them numerous grains of pollen dust in exchange.

What a lesson for men in the relations of the bees and butterflies with the flowers! There is keen competition and lively bidding for insect favor, but there are neither strikes nor price-cutting wars. A sip of nectar for a dash of pollen has been for countless generations the ruling quotation. Both flower and insect are satisfied with the bargain, and each passes through the years glad that it can be of service to the other and happy that the other can serve it so well.

The first instinct of every flower is so to live that when it dies it may live again, not in its own being, but in generations of sturdy progeny. Innumerable are the expedients which they employ to bring about that happy result.

Some of them, like the rose of Jericho, pack up bodily when the dry winds of the desert come along, and roll before them, root and branch, until they strike some moist place,

where they unpack and start life again. Others tie sailor knots or make elastic springs. When the seeds are ripe, these stretch like a rubber band, break, and catapult the seeds like a pea-shooter.

Still others put hooks in their seeds, so that they can send them far and near by stealing rides on animals, such as the cockle bur. And then there are others that were perpetuating themselves by their mastery of the principles of the parachute countless generations before man dreamed of a balloon.

Among these latter is the fireweed. It has a slender, curved, violet-tinted pod in which are nested numerous seeds, each attached to a tuft of fluffy, white, silky thread. When the seeds are ripe, the pod bursts open, and as the winds come along they start the little seed-laden parachutes a-sailing through the air to destinations whose distance is limited only by the velocity and the duration of the wind.

And so it sends its children far and wide, hoping that each one may land in some hospitable spot, ready with the advent of another summer to become, in its turn, the founder of other colonies.

NEW ENGLAND ASTER (Aster novae-angliae L.)

(See page 605)

Like its cousin the thistle, and like the daisy and the sunflower, the aster is one of the most civilized of flower peoples; so well have they adapted themselves to the necessity of varying environment that they have been able to travel around the earth and to make themselves at home wherever they go.

They ask odds of nobody. Through countless generations they studied the best methods of insuring their survival against the fiercest competition, and finally developed the idea of the composite flower. It was like a Forty-niner striking a bonanza mine! And so we find them wholly self-reliant, self-sufficient, and ready to fight all comers for their right to a place in the sum of existence.

When they started out they were like the grass—dependent upon the wind to carry their pollen; but as they journeyed down through the ages they gradually discovered that the wind was not always a trustworthy messenger. The more progressive among them decided to employ insects instead of breezes as their pollen-bearers.

Their first "help wanted" advertisements were a few dainty flower petals, but this innovation was so successful that they began to do a land-office business. They found that myriad armies of insects were ready to be mustered into their service.

So successful indeed was the experiment that they decided to extend their business still further, and to employ in their appeal for recruits display ads in the shape of great groups of flowers instead of want ads in the shape of isolated blossoms.

And their second adventure was as successful as the first. They offered high wages in easily reached and abundant nectar of the best quality, with the result that they were able to command the services of the most reliable of the messengers of all insectdom.

Their brands of nectar were so well advertised and maintained such a high standard of purity that their big page ads drew vast hordes of winged Mercuries, and, having become the biggest users of printers' ink in flower land, their respective establishments grew and grew until their names became household words in insectdom.

Today they are the captains of industry, the Napoleons of finance, and the people with a vision of flower land. The daisy army transforms millions of acres into white and gold in summer, while in autumn the aster and golden-rod proclaim their triumph through millions of acres of yellow and blue.

There are about 120 species of asters in the United States. The New England aster, the subject of this sketch, is one of these. It occurs most frequently in New England, as its name implies; but it has been extending its territorial possessions somewhat, and now occurs in the maritime provinces of Canada and as far south as the Gulf of Mexico. Its flowering season is from August to October, and its favorite habitat swamps, moist fields, and roadsides.

WILD YELLOW OR RED PLUM (Prunus americana Marshall)

(See page 606)

With a flower as fair as any that blooms, even though it is but a small blossom, and fruit that, with its rare transparent coloring, is the soul of beauty, the wild yellow or red plum has a host of friends who rate it high in the order of things delightful to the eye.

This plum is a genuine American, having dwelt here even before the legendary Norsemen came to these shores. And it is of such sturdy stock that it has been widely used to give new life and to infuse new hardiness into the effete plums that have come to us on the wings of commerce from Europe.

Since the scientists have become masters of the art of cross-breeding trees and plants, they have learned to couple the hardy, self-reliant, disease-resisting traits of the wild species with the improved fruit-producing traits of the tame varieties that have come to it through centuries of selection. In that way they have given us a long list of new and improved plants.

They go to the desert for clovers to cross with our ordinary stock and give us drought-resisting pastures; they go to Peru for "new blood" for our potatoes, and we get hardier varieties than we had before; they take the hardy Japanese bitter orange and cross it with the domesticated orange and get a wider area for its cultivation.

And so the wild plum has been made to do duty in the development of a dozen or more

varieties of cultivated plums. Its range is from the Atlantic coast west to the Rocky Mountains and south to the Gulf of Mexico. It blossoms in April and May and bears fruit from August to October, preferring to grow in narrow, open woods and along the borders of streams.

The plums are distinguished from the peaches through their smooth coats and their unwrinkled seeds. It is a curious fact that the varieties derived from the wild yellow or red plum and its related American species, and also the Japanese plum, are practically sterile to their own pollen, and do not produce profusely enough for profitable cultivation unless within reach of other varieties for cross-fertilization.

The plum has its own peculiar enemies, both fungus kind and insect kind. One sort of fungus which attacks it begins its work soon after the plum sheds its bloom, and as the fruit begins to grow it develops a "plum-pocket" an inch or two long, which presents a hollow, bladder-like appearance. The attacked fruit develops with thickened walls, but with no pit. The fungus also attacks the leaves and stems, causing them to assume a bloated, distorted appearance.

The insect which is the especial enemy of the plum is the curculio, a small, rough, grayish black beetle about one-fifth of an inch long and with two peculiar bumps on its back. The female selects a plum in which to deposit an egg. With her little snout she makes a short slit about one-sixteenth of an inch deep and places her egg therein. Then she cuts another slit, crescent-shaped, in front of the other one, in such a way as to cause that side of the plum to wither and to prevent the fruit from healing up around the egg.

When the larva hatches out, it feeds on the fruit around the stone until the plum, now thoroughly diseased, falls to the ground, carrying it along. It then climbs out of the fruit, digs down about a third of a foot into the ground, and there makes a little cell in which it transforms itself into a pupa in from three to six weeks. As an adult it emerges, selects a place for hibernation, and sleeps until next year's trees begin to bud, feeding on twigs and buds until the fruit begins to form.

THE CITIZEN ARMY OF HOLLAND

By Henrik Willem Van Loon

Author of "The Fall of the Dutch Republic," "The Rise of the Dutch Kingdom," Etc.

THE Holland with which we are all familiar is a picturesque combination of dikes and windmills, smiling girls with pretty lace caps, and very small boys with very big cigars. There is another side to this picture to which we have paid less attention; that is the Holland of the modern merchant and the modern scientist—a small bit of land teeming with industry and busy with a thousand different affairs—a country administering a vast colonial empire without the use of a large military establishment and capturing Nobel prizes at a most enviable rate.

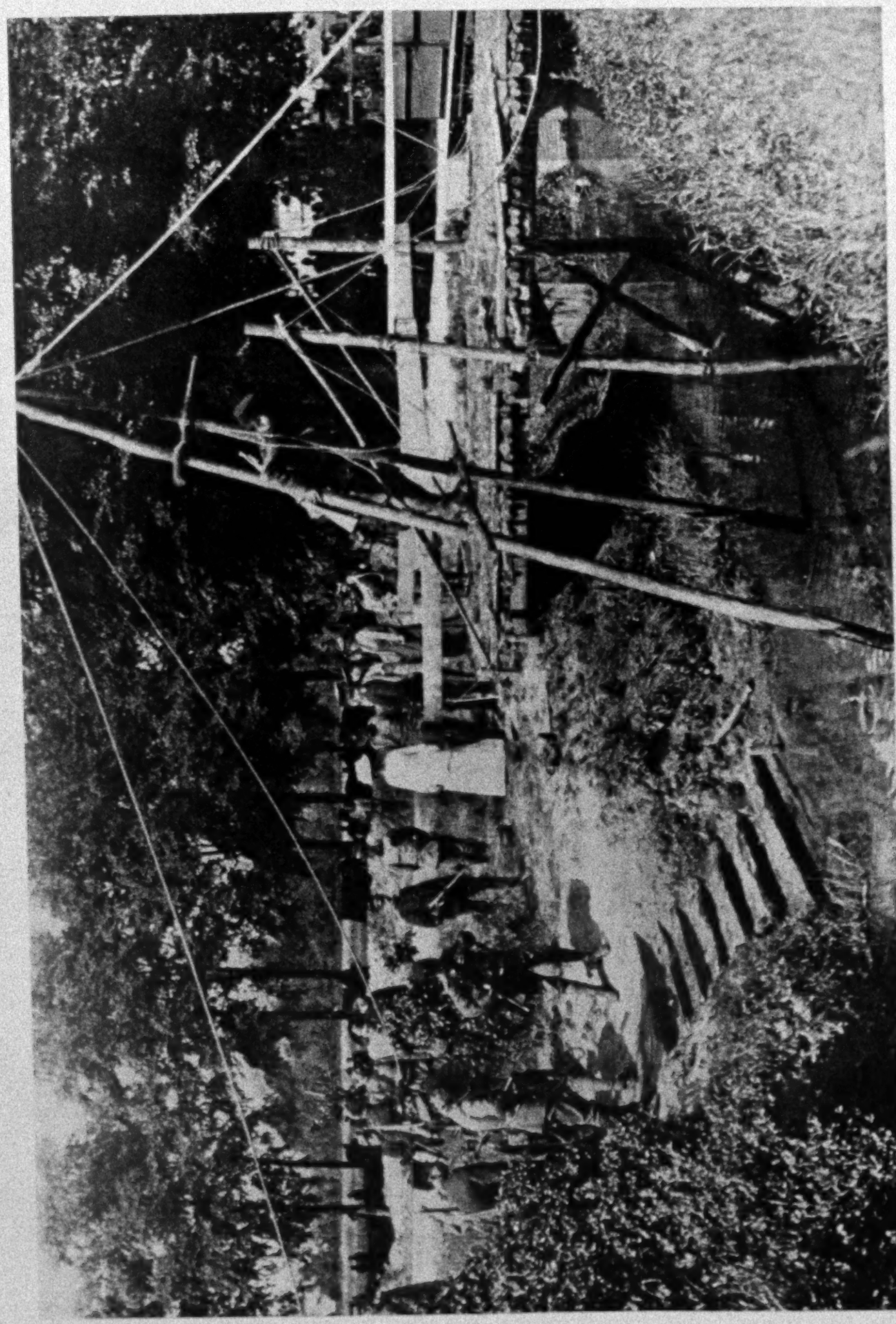
This modern Kingdom, with its harbors and its vast foreign trade, forms a small but concise national unit in the midst of very powerful neighbors, who for over two years have been engaged in the most gigantic of all wars. Yet Holland has managed to keep out of the struggle with lasting success. It was able to do this because in a military sense it was fully prepared for all eventualities.

A COMPARISON OF BELGIUM AND HOLLAND

The Kingdom of Belgium was not prepared for war and it was invaded and overrun by a hostile army. The Netherlands, although smaller in number of inhabitants, had the entire arm-bearing force of its male population at the frontier 48 hours before any of the other nations of Europe mobilized. As a result, the neutrality of the country has been rigorously respected.

Strategic reasons, however, for an invasion of the country have been present ever since the month of October of the year 1914, when the Germans captured Antwerp. A cursory glance at the map will show that the Germans thereby acquired the most important naval base in their warfare upon England. Yet they could not use it as long as Holland closed the mouth of the Scheldt with mines and gunboats and land fortifications.

Upon several occasions there was an uneasy and panicky feeling that the Ger-



QUEEN WILHELMINA INSPECTING THE WORK OF HER EXPERT DETACHMENT OF ENGINEERS

man armies might try to force the mouth of the Scheldt and make Antwerp a naval port for the benefit of their submarines and warships. During many anxious weeks the people of the Netherlands have had the unpleasant sensation that the General Staff of the German armies was figuring and computing the exact debit and credit side of a violation of Dutch territory. Often it seemed that the next morning might bring the news of a German invasion. But every time thus far the careful accountants of the efficient Imperial Staff must have come to the conclusion that an invasion of Dutch territory would cause more harm than good. The troops which had been massed on the southern frontier of Holland disappeared; the guns went rumbling back across the heavily paved roads of Flanders, and the port of Antwerp remains closed to this day.

The activity of the Dutch army, however, has not been directed exclusively against the eastern neighbors. Holland knows that it would provide an excellent thoroughfare to the Rhine region and the steel works of the Krupp family; therefore every quarter mile of the entire coast is guarded day and night. The sand-dunes, which provide a wonderful natural barrier, have been fortified with hidden guns and well-covered positions for machine guns. The towns and villages situated behind the dunes are well garrisoned, and an excellent system of roads running parallel with the coast enabled the Dutch Government to transport artillery and infantry to any threatened spot within less than an hour. Torpedo boats and a flotilla of submarines patrol the coast at all times. Thus far they have been able to save the lives of many shipwrecked sailors, but they have not been called upon to do active service.

FIREPROOF THOUGH SURROUNDED BY FIRE

All this is in keeping with the heavy sacrifices which the Dutch people have for years made for the defense of their country. They do not intend to use their army for any purpose of aggrandizement; they do not expect that the few hundred thousand men which they are capable of bringing into the field will ever decide the fate of Europe; but they intended to create an army and a navy of such strength that any enemy who should wish to attack the small country would be obliged to reckon the cost before he dare to make the attack.

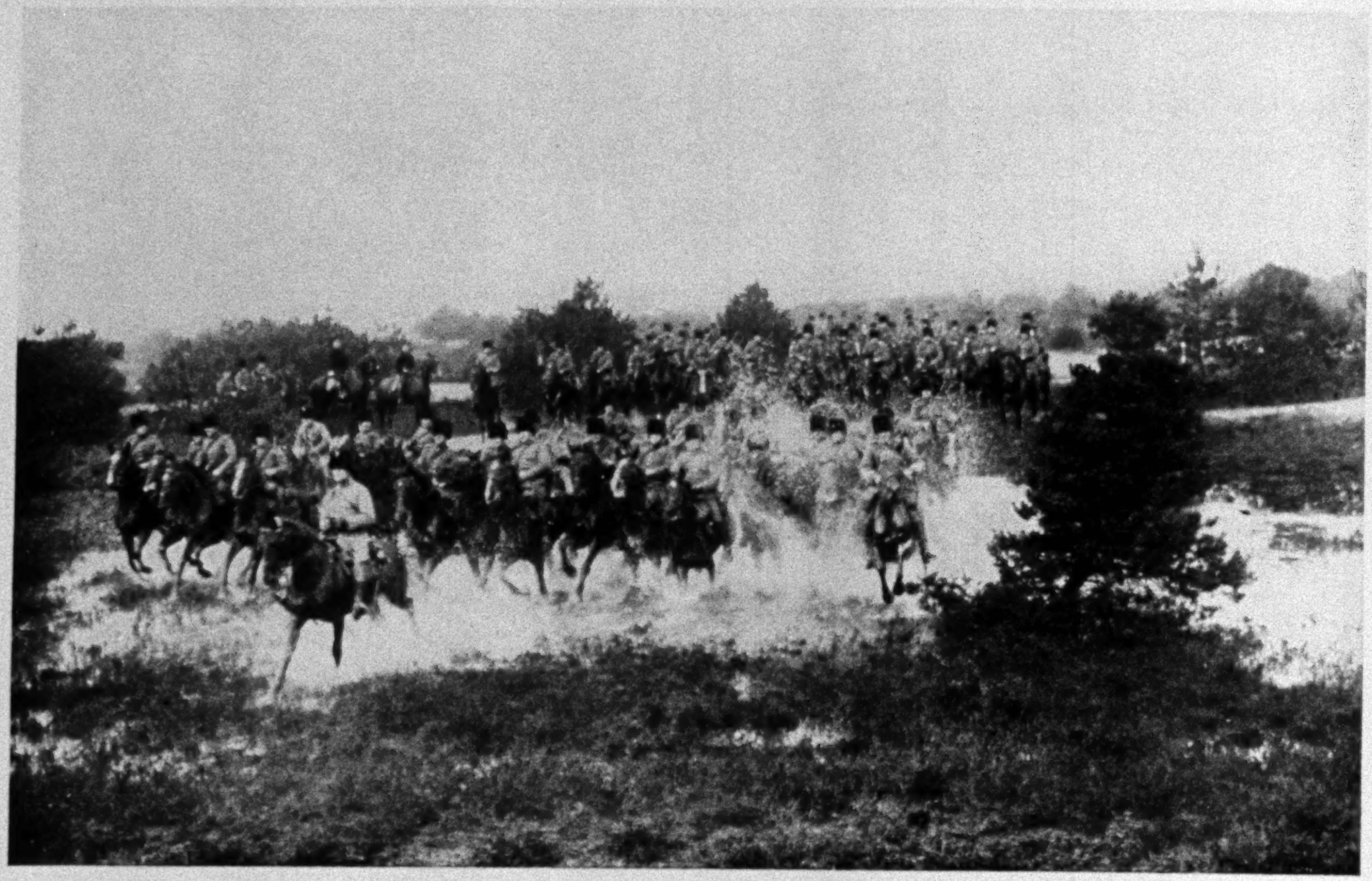
They made a soldier of every man capable of bearing arms. They prepared the principal part of the country for immediate inundation, and then quietly made it known to their neighbors that they would regard a nation which should cross their frontier as their enemy.

The result thus far has been beneficent to the small Kingdom. The conflagration has spread to all parts of Europe. This little triangle of sand and marshes, situated right in the middle of the terrible upheaval, has been spared. Unless unforeseen circumstances shall happen, Holland will not take part in the war. The outlay of countless hard-earned millions and the willingness of all men to submit to a few months of drill has accomplished this feat.

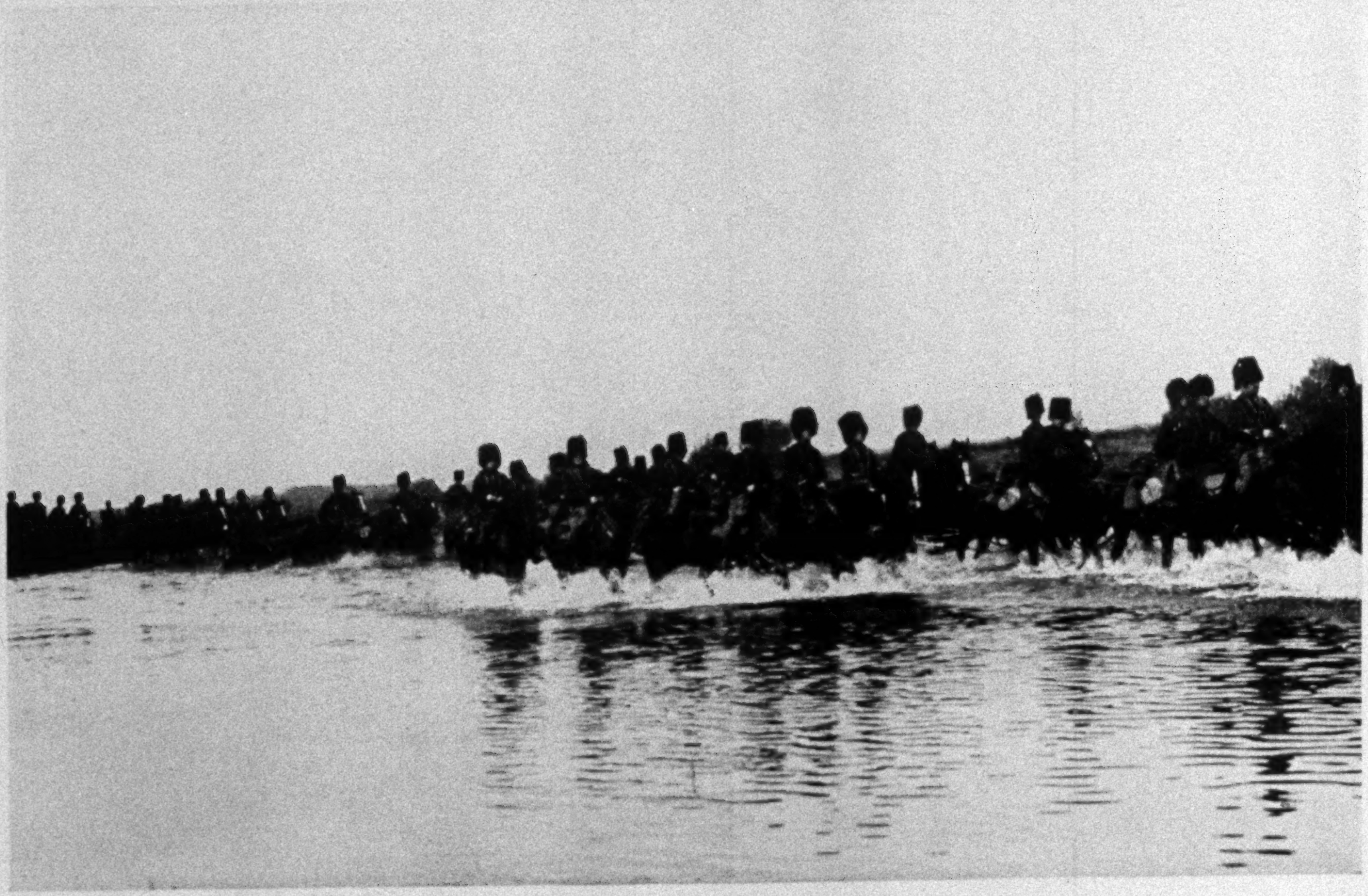
Together with Switzerland and Denmark and Norway and Sweden, Holland owes its salvation to its own labors and sacrifices. It was a lesson which was not easily learned, but which will not lightly be forgotten after the terrible example of Belgium.

THE TRAGIC LESSON BEQUEATHED BY OLD HOLLAND

It is a sad reflection that just one hundred years ago Holland was in the same position in which her southern neighbor finds herself at the present moment. The old Dutch Republic of the sixteenth and seventeenth centuries had grown too rich in the eighteenth century. Millions for tribute, but not a cent for defense had become the watchword of the self-contented rentiers, whose grandfathers had amassed fortunes and who were not willing to spend a penny of their comfortable dividends upon either an army or a navy. Whenever they needed soldiers they hired a few regiments of Germans or Scotchmen. They allowed the ships of the navy, which had made their country the leader of Europe's foreign policies, to rot in the harbors, and for over forty-three years did not spend a guilder for the maintenance of the fleet.



DUTCH CAVALRY IN A PRACTICE MARCH



DUTCH ARTILLERY FORDING A SMALL RIVER

This is the only regiment which retains the old Napoleonic bearskins. It is a regiment of light artillery. It operates in the territory which is most exposed to attack, and its duty is to defend the rivers which run toward the North Sea and the Zuyder Zee.

A MOUNTED MACHINE GUN CARRIED BY TWO HORSES THAT JUMP AS ONE

In modern warfare machine guns have become almost as plentiful as rifles. The cavalry horses of Holland are trained jumpers, for to be most useful in the defense of the country they must be able to jump canals readily.

Several times the government of the Republic was called upon to fulfill the stipulations of some ancient treaty of alliance and to provide her friends with a certain number of ships and a few thousand men. Instead of sending ships, the Dutch Government produced an unlimited checkbook, made some sort of humiliating compromise, and bought herself out of all honorable engagements.

When the Dey of Algeria captured Dutch ships trading in the Mediterranean, he was offered an annual bribe if he would desist from bothering Dutch commerce. When British privateers burned Dutch fishing smacks off the coast of Zeeland, the people rushed into print and denounced the wicked Englishmen. But nobody thought of fighting these enemies as their fathers had done.

It was a sad story. The less we say about it the better. The reward for this policy of indifference and cowardice came in the year 1795. In less than a week the entire Dutch Republic of mighty memory fell into the hands of the French revolutionary hordes. Holland in the sixteenth century had been a large business house defended by a mighty fleet. In the eighteenth century it became an opulent savings bank, which refused to provide for a new door and new shutters because "it would cost too much." The French revolutionary soldiers, soon followed by Napoleon the First, pushed their way into the treasure-house of this feeble Commonwealth, declared it to be part of the French Empire, removed everything of any value, and after twenty years of systematic pillaging they turned the erstwhile powerful Republic into a geographical idea, without men, without money, without hope, and without courage.

When finally, on the nineteenth of October, 1813, old Blücher, cursing and swearing at the Corsican usurper, forced his way into the city of Leipzig and turned the French defeat into a rout, there were not more than a dozen men in the former Republic willing to risk their lives for the liberty of their country. It is a matter of record that during the first week after the flight of the French troops from Holland the regular Dutch army did not count more than 651 men.

From that moment, however, there was a steady improvement. The Kingdom of the Netherlands was formed, under the leadership of the old House of Orange. Every man capable of bearing arms was drafted into the national defenses, and much of the ultimate success of the battle of Waterloo was due to the Dutch forces at Quatre Bras, who engaged the superior advance guard of Marshal Ney until the Duke of Wellington had put his army into battle array.

EVERY BOY IS TRAINED TO DEFEND HIS COUNTRY

From the year 1815 on, every boy of nineteen in the Kingdom has been obliged to prepare for military service. It is not desirable to give the exact number of soldiers in the army which has been mobilized since July of the year 1914. But in a general way we can state that every male being in the country who is of good physical condition and who can walk with a gun across his shoulder has in some direct or indirect fashion given part of his time and his services for the benefit of his country. The old law, which made an exception for only sons, was rescinded several years ago. The Napoleonic system, which allowed rich young men to buy themselves out of the army, has been abolished. The army is now a democratic school, in which classes are thrown together for one common purpose.

Every young man who has reached the age of 19 years appears at his special garrison. For a full year he is instructed in the rudimentary principles of a soldier's trade. If he cares to enter the special service of artillery, aircraft, or submarine work, he will have to spend one or two years more. In that case, however, he learns a useful trade which will help his chances in his future work.

When he has been taught his business he goes back into private life. Except for a short annual maneuver, he has nothing further to do with the military system until a sudden emergency shall call him back to the colors.

THE NORTH SEA IS HER BEST ALLY

Holland can hope to accomplish great things with comparatively weak forces,

THE DUTCH CYCLE COMPANY ON THE MARCH

In addition to its infantry, artillery, and cavalry, the Dutch army has a "bicycle brigade," a company of men who are noted for their ability as riders and marksmen. It is their duty to destroy all bridges in case of invasion (see page 617).

because it has an ally, mightier than either steel or iron or high explosives. That ally is the North Sea. The Kingdom of the Netherlands is a mud-bank conquered from the ocean. Open the dikes which defend the land against the angry aggression of the sea and the country will disappear beneath 3 feet of water. This excellent method of defense was known to our ancestors. It was first used in the year 1572. In the month of April of that year a number of starving Dutch revolutionists captured a small Dutch town named Brielle. The Spaniards tried to reconquer it. The Hollanders opened the locks of the Meuse. The water came and the Spaniard went.

A few years later the town of Leiden, situated in the heart of the country, was delivered from Spanish siege by a fleet of Dutch catboats and flat-bottomed scows sailing across an impromptu lake and storming Spanish forts after a charge of swimming and wading sailors.

A century later the entire military power of Louis XIV of France was turned against the Dutch Republic. The French army, fresh from victories in many parts of Europe, came to grief when William III inundated the principal part of the Province of Holland and threatened to drown the invader.

In the year 1815, when the new Kingdom of the Netherlands was definitely reconstructed, it was decided to use the water in a scientific fashion for the defense of the country. The eastern part, flat and covered with heath, was to be left open to invasion. The heart of the country, 9 feet below the level of the sea, was to be turned into an ingenious fortress.

At the present time the old idea has been continued with but small changes. A strong force of cavalry and infantry provided with bicycles is left for the defense of this territory. These men must try and stop the invading power as long as possible. It is their duty to destroy all bridges and to dispute any attempt of the enemy to cross the big rivers.

HOLLAND IS SURROUNDED BY MOATS

Meanwhile the regular army has retired behind the system of fortresses and inundations, which are all together designated as the "Waterline."

The "Waterline" consists of two parts. The first line of defense runs from the Zuyder Zee due south to the lower parts of the rivers Meuse and Rhine. It cuts off the provinces of north and south Holland and half of the province of Utrecht. It creates a large artificial lake, from 6 to 10 miles wide, which covers all roads, canals, bridges, railroad tracks, and fences.

In many places where an attack might be expected barbed-wire fences have been constructed in such a fashion that they shall be completely covered by the water. The few trenches which guard this line of defense on the east can be turned into ditches. It will offer the forlorn aspect of a large tract of flooded territory. The thousands of trees, the network of fences just below the surface of the water, will make navigation an impossibility.

At irregular intervals there are more than 40 little islands armed with heavy guns. They cover all the roads which in normal time cross this territory, and they know the exact range of every foot of ground (or rather mud) in the waterline.

Behind this first line of defense stretches the second one, which is also the most important. It consists of another group of inundations and some forty-eight fortifications, and forms a broad circle of defense for the town of Amsterdam. Here the strength of the country has been concentrated, and ever since the beginning of the present war every lock and every dike has been guarded. Within six hours this territory would be ready to resist an invasion. Within twelve hours thousands of acres of the most fertile grazing grounds would be covered with four feet of salt water. After a day and a night neither man nor machine could cross the artificial sea surrounding the heart of the country. The much dreaded shells of the heavy siege guns would cause a big splash, but would do no damage.

This is not a mere supposition written in a moment of patriotic self-glorification. Our statement is based upon the German experience along the Yser front. The

DOG AND MAN ALIKE MUST PULL IN DEFENSE OF HOLLAND'S DUNES

The Dutch sowed a sand grass upon the dunes and bound their shifting sands; and now the dunes are ramparts of defense. They dammed back the seas and, foot by foot, won much of their territory from the ocean, which nevertheless protects them from human foe, because no nation has soldiers tall enough to keep their heads above water should the sturdy Hollanders call the seas to their aid.

WAR DOGS AT WORK IN HOLLAND

Dogs have always been used in the low countries for the transportation of light carts or the towing of ships in canals. These machine-gun dogs, a special variety which is being bred for this sort of work, resemble Eskimo dogs in their vitality and high spirits. They keep cheerful and good-natured long after the human machine has yielded to fatigue.

HEAVY ARTILLERY PASSING THPOUGH THE CANALS OF HOLLAND

The coast is defended strongly, the works barring entrance to the Zuyder Zee and to the Amsterdam and Rotterdam canals being of the highest art in mintary engineering

A PORTION OF HOLLAND'S AËRIAL FLEET AT SCHEVENINGEN

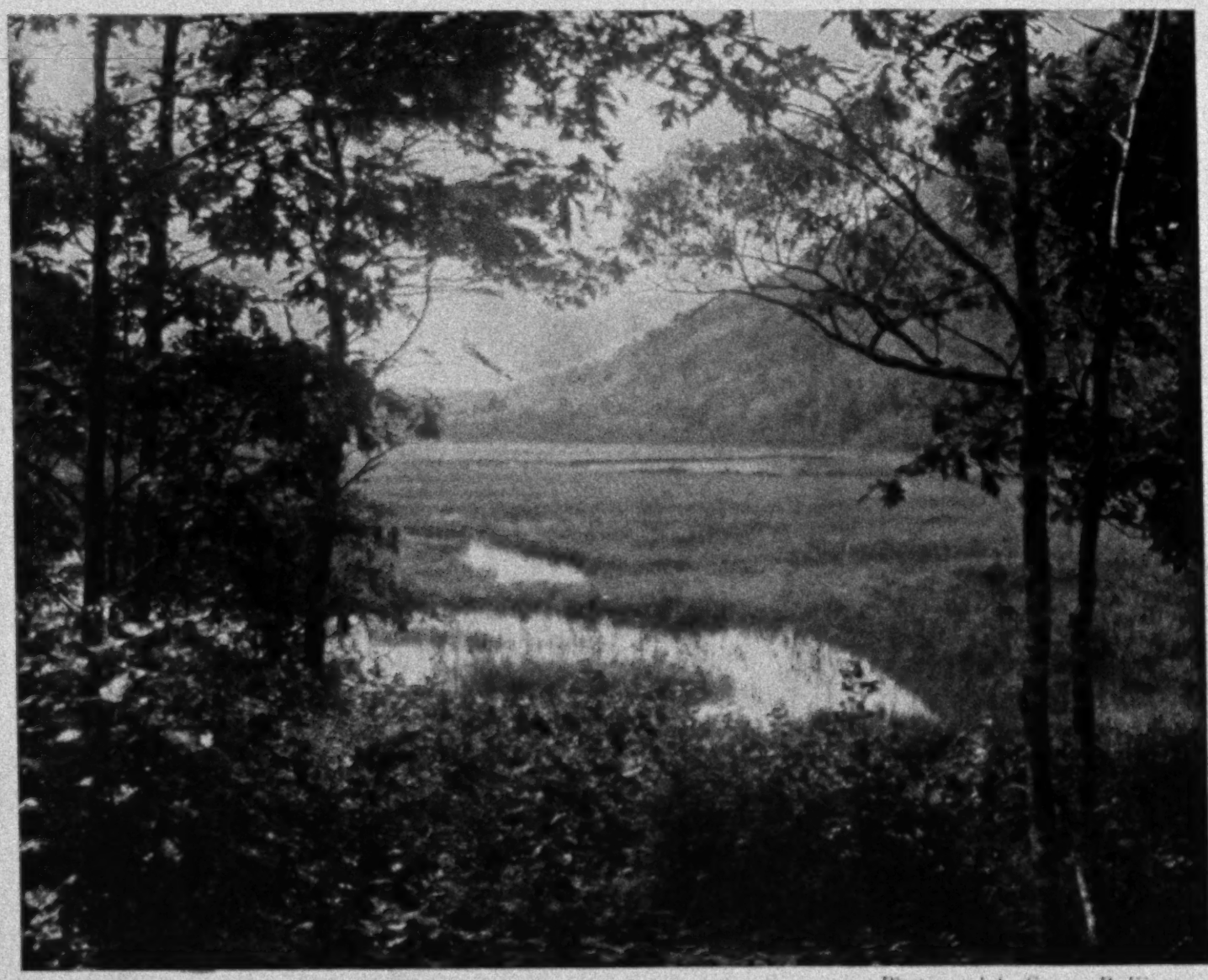
Just as Switzerland has remained an island of peace in a sea of war, so Holland remains an oasis of happiness in a desert of carnage

southern part of Flanders, in which the heaviest fighting of the year 1914 occurred, greatly resembles the watery part of the Netherlands. It is a region of low pastures and high skies, ditches, rain, and salt spray. The opening of the locks at Nieuport flooded the land on both sides of the Yser Canal. Behind this the remains of the Belgian army were able to withstand the first shock of the German army marching for Calais.

After almost two years of patience and ingenuity, the Germans have not advanced a single yard against this stagnant lake, which is now the burying ground of many thousand young and brave fellows. The ordinary methods of war were of no avail. Boats, floats, complicated rafts have all been tried and have been given up as useless. The remaining part of Belgium is safe behind this bulwark of our faithful old ally, the North Sea.

The people of the Netherlands know that they will exist as an independent nation just as long as they are able to take care of themselves. For this purpose they have made it the duty of every man to give part of his time to the service of his country. For this ideal they are willing to sacrifice the better part of their territory and to surrender it temporarily to the waves rather than allow an occupation by the force of an enemy.

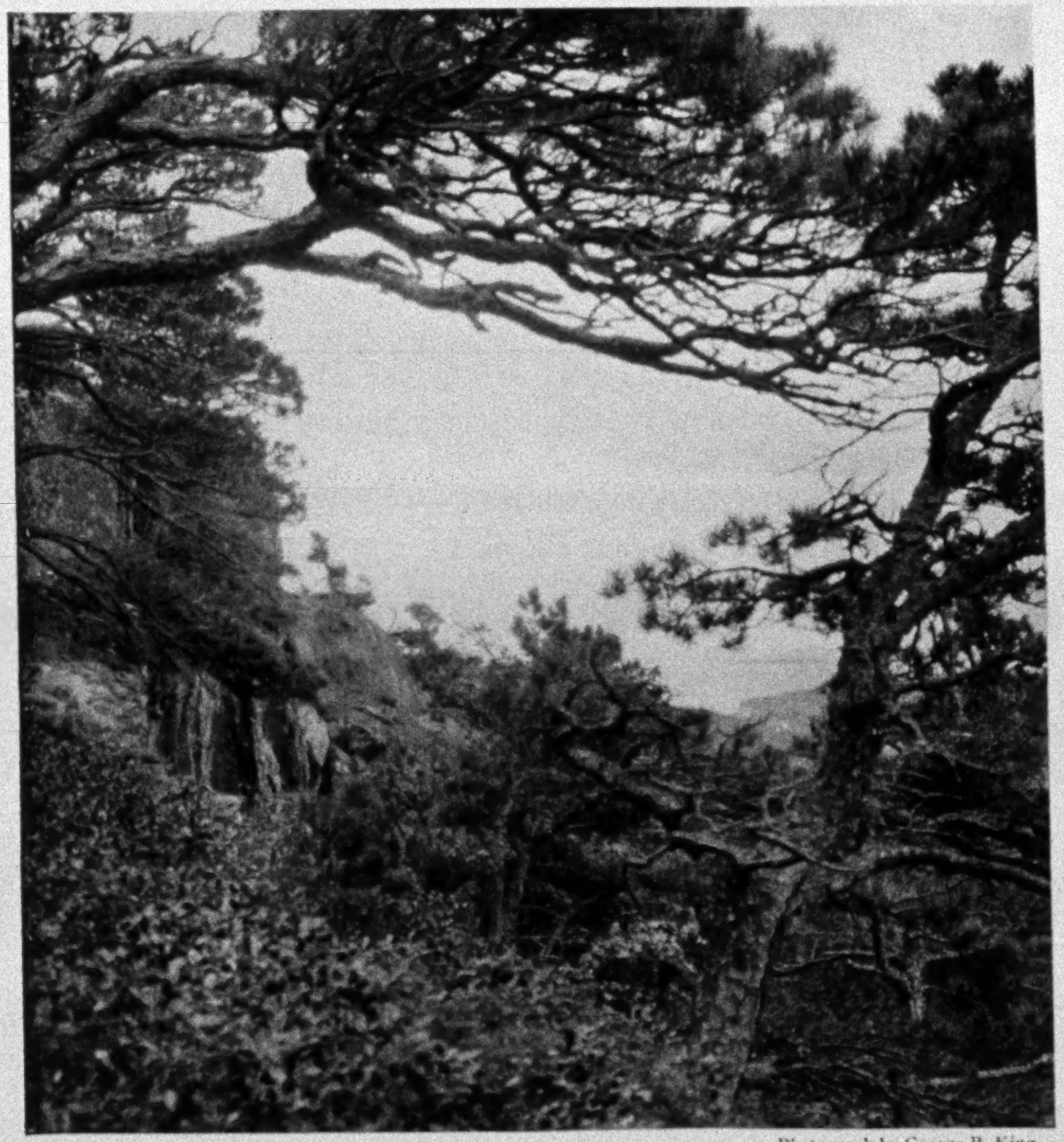
Because of their industry and foresight in preparing themselves for the unexpected, no hostile force has crossed the frontiers of their tiny country during the last one hundred years.



Photograph by George R. King

A SCENE IN SIEUR DE MONTS NATIONAL MONUMENT, MT. DESERT ISLAND

A wild sheet of water that fills the deep glacial gorge of Indian Pass and lies between the Gates of Eden



Photograph by George R. King

VIEW TAKEN ON THE BEACHCROFT PATH, MT. DESERT ISLAND

Built as a memorial to an island home and leading boldly up the pine-clad ledges to Huguenot Head and a glorious ocean view

FIRST NATIONAL PARK EAST OF MISSISSIPPI RIVER

In the July issue, 1914, of the NATIONAL GEOGRAPHIC MAGAZINE appeared a group of articles by Charles W. Eliot, President Emeritus of Harvard University; George B. Dorr, E. H. Forbush, and others, telling of the intended gift to the Nation of a National Park upon Mount Desert Island, the culminating point of the beautiful coast scenery of Maine. After two years of further work upon the donors' part, spent on the improvement of boundary, approach, and title, this gift of unique and splendid landscape character has been accepted by President Wilson, and now stands dedicated forever to free public use and to purposes of bird and other wild life conservation, under the title of the Sieur de Monts National Monument.

Its acceptance marks the beginning of a new era in our National Park development, it being the first National Park—apart from battle monuments and forest reserves—to be established in the vast and wealthy eastern region of our country—the region of early occupation, of densest population, and greatest public need.

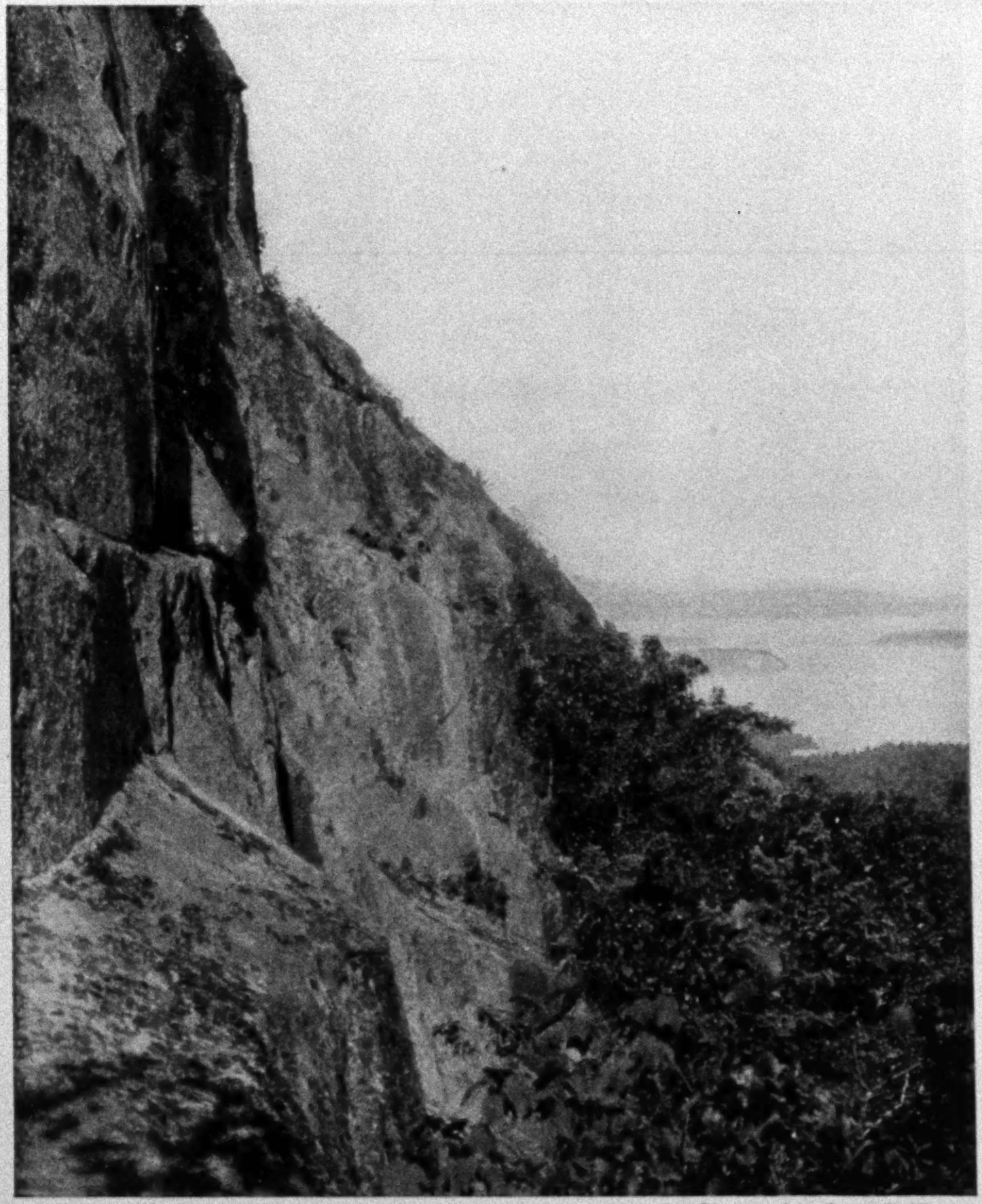
Photograph by George R. King

VIEW FROM THE SUMMIT OF NEWPORT MOUNTAIN: LOOKING NORTHWARD ACROSS FRENCHMANS BAY TO THE GOULDSBORO HILLS

Photograph by George R. King

VIEW OF GREAT HEAD AND THE SAND BEACH, TAKEN FROM THE HOMANS GIFT, MT. DESERT ISLAND

A superb headland bounding on the south the National Park. The beach below and rocky shore beyond were bought some years ago by the late J. Pierpont Morgan and given to one of his daughters, whose summer home it is, but who generously leaves the old-time path across them open to the public.



Photograph by George R. King

THE PRECIPITOUS GRANITE CRAGS OVERHANGING SIEUR DE MONTS SPRING

Our first National Park east of the Mississippi River, the Sieur de Monts National Monument, was the first land to be visited, described, and named by Champlain when sailing under de Monts' orders in the exploration of the New England coast.

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For supper, for lunch—
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We flavor it with celery, parsley and other delicate herbs. And we add a sprinkling of "alphabet" macaroni to increase the attractive appearance.

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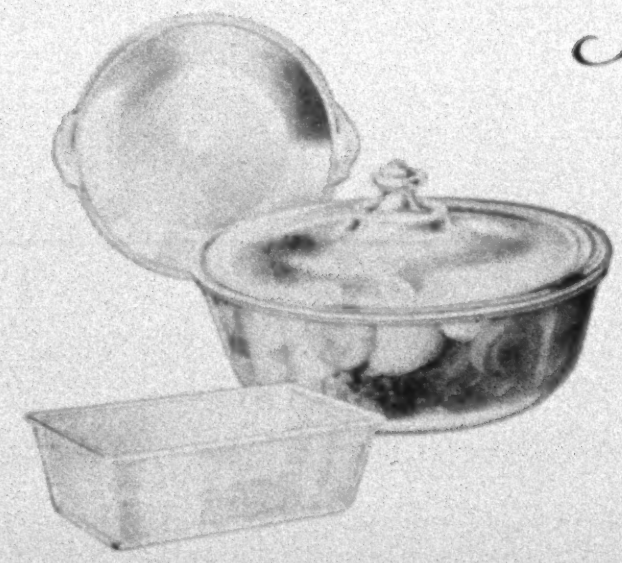
21 kinds **10c a can**

Campbell's Soups

LOOK FOR THE RED-AND-WHITE LABEL



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PYREX Baking Ware

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Owing to the unusual heat-transmitting qualities of Pyrex, food bakes quicker and more uniformly, thus saving time and fuel, and producing better baking. The progress of the baking may be seen right through the dish. Food in Pyrex doesn't burn.

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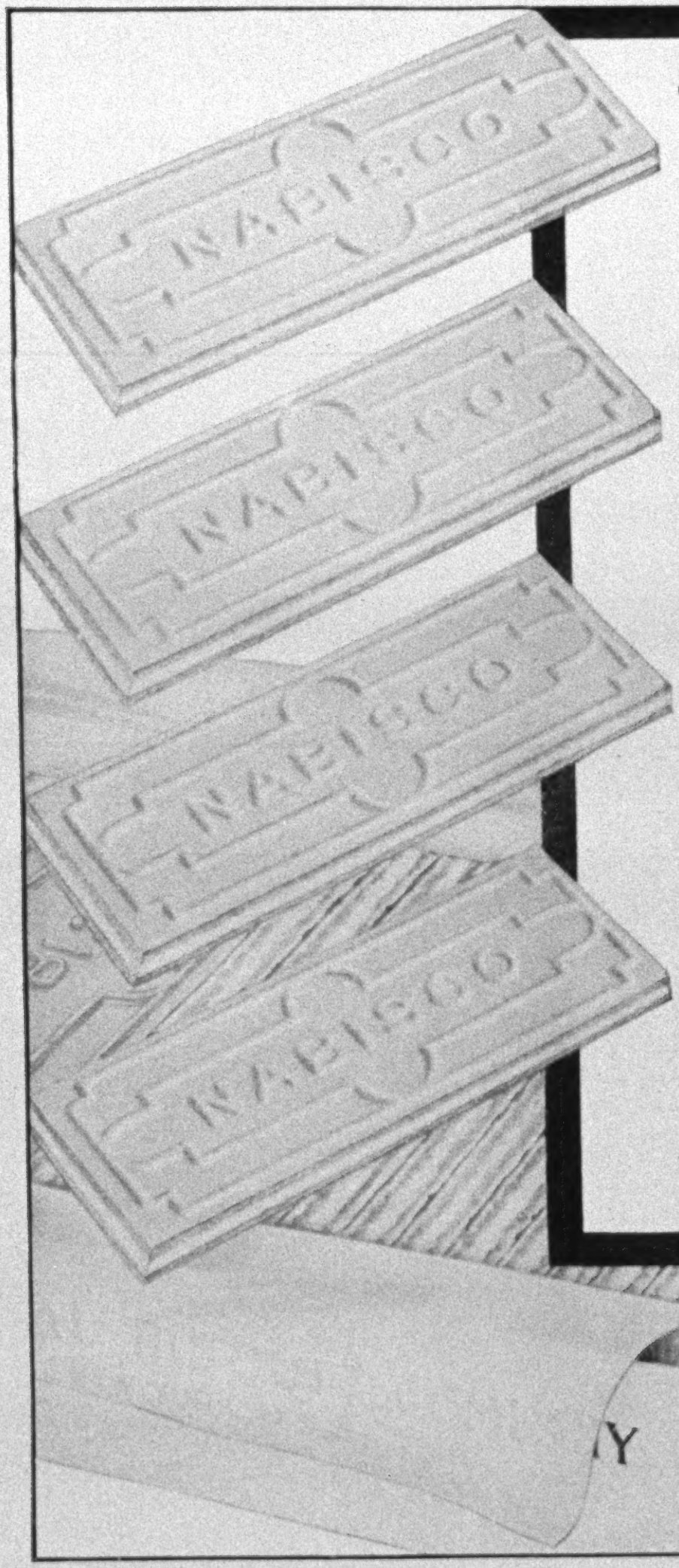

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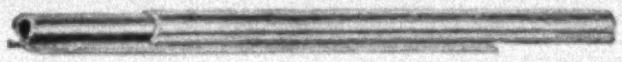

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The original instrument—the very first telephone in the world—is shown in the picture above.

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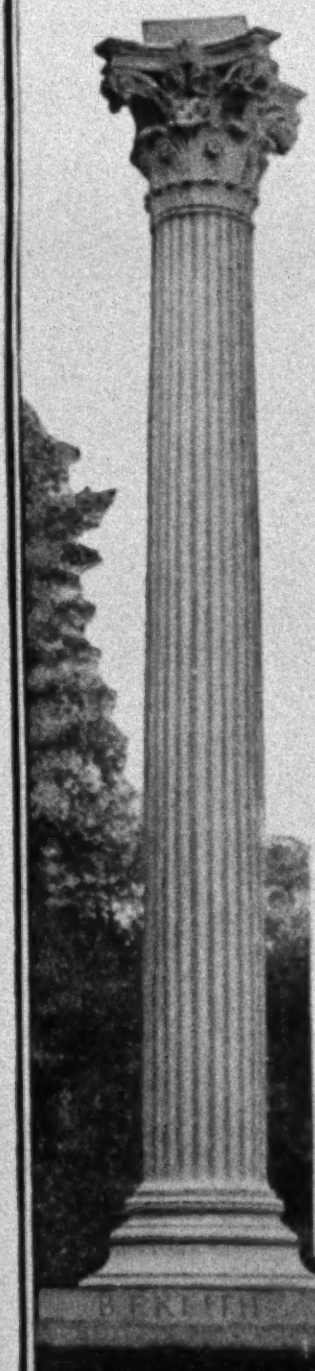

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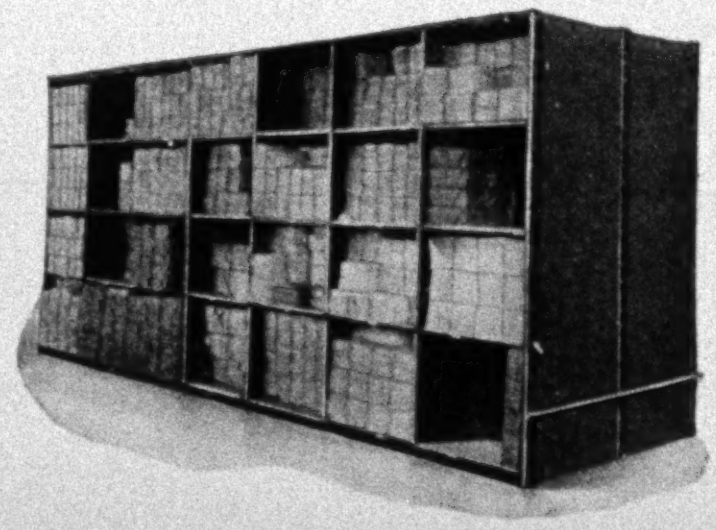


IT will pay you to tear out the old wooden shelving in your store-room and install a uniform equipment of Durand Steel Racks and Bins.

Durand Steel Racks are fire-proof and easy to keep clean. Wooden shelves, usually oil-soaked and dusty, increase your insurance costs.

Durand Steel Racks are smooth-surfaced and easy on containers. Rough wooden shelves often tear the bottoms out of paper boxes, wasting stores and time.

Durand Steel Racks will support great weight. Wooden shelving may collapse under exceptional weight, damaging stock and injuring employees.

Durand Steel Racks are strong, convenient, commodious, compact and practically indestructible.

DURAND STEEL LOCKER CO.

1507 Ft. Dearborn Bk. Bldg. Chicago

907 Vanderbilt Bldg. New York

A Stucco Home or Garage

Have you considered Stucco for your home or garage? Stucco in first cost is low. It requires almost no painting or repairs, and resists fire.

Stucco is a material of great natural beauty. Finished with Atlas-White Cement it presents a pure white exterior that contrasts attractively with surroundings; or it may be tinted artistically in cream, buff, brown, and other warm mellow tones.

To Help You Decide

Ask your architect about Stucco. You will find it useful to have the Atlas-White Home Portfolio or our Garage Book, which give the advantages of the various types of home and garage construction and illustrate many beautiful homes and garages. Either or both will be sent on request—use the coupon below.

The Atlas Portland Cement Company

Members of the Portland Cement Association

30 Broad Street, New York or Corn Exchange Bank Bldg., Chicago

Philadelphia Boston St. Louis Minneapolis Des Moines Dayton

Atlas-White Stucco Home and Garage Forest Hills Gardens, N. Y.

ATLAS WHITE

THE ATLAS PORTLAND CEMENT COMPANY, 30 Broad Street, New York, or Corn Exchange Bank Bldg., Chicago

Send to name and address below Atlas-White (check the one you want) Home Portfolio Garage Portfolio 1-D-6-16 I expect to build $_____ Home $_____ Garage

"Mention the Geographic—It identifies you."

"Word of Honor"

WHEN A MAN puts his name on a product he gives a pledge to the public which only quality can make good.

The value of a well-established name, therefore, is in the honor and good faith for which it stands.

On every Firestone tire there is stamped the name of the founder of the the world's largest exclusive tire company—H. S. Firestone, president of the Firestone Tire and Rubber Co.

In the new color combination, RED AND BLACK, Firestone builders add elegant appearance to "Most Miles per Dollar."

FIRESTONE TIRE & RUBBER CO.

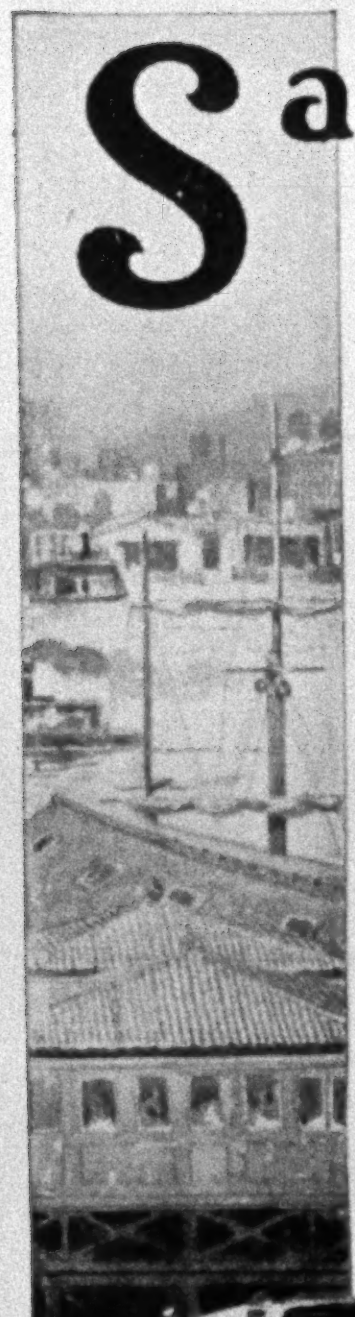
"America's Largest Exclusive Tire and Rim Makers"

AKRON, OHIO

Branches and Dealers Everywhere

Firestone

NON-SKID TIRES



Satisfaction in Electric Car Service means one of

The 4 "Exide" Batteries

"Exide", "Hycap-Exide", "Thin-Exide", "Ironclad-Exide"

The reputation of these batteries has been established by service *facts*—not claims on paper.

They have been giving powerful and consistent service to both pleasure and commercial electric vehicles ever since the inception of the industry.

To give dependable service Electric Vehicles must be equipped with a dependable battery. And because "Exide" Batteries have so unfailingly demonstrated such dependability they are today used and endorsed by the following prominent manufacturers:

American Electric Car Co.
Atlantic Electric Vehicle Co.
The Baker R. & L. Co.
Beardsley Electric Co.
Commercial Truck Co.
General Motors Truck Co.
General Vehicle Co.
Hupp-Yeates Electric Car Co.
Ohio Electric Car Co.
Walker Vehicle Co.
The Waverly Co.
Woods Motor Vehicle Co.

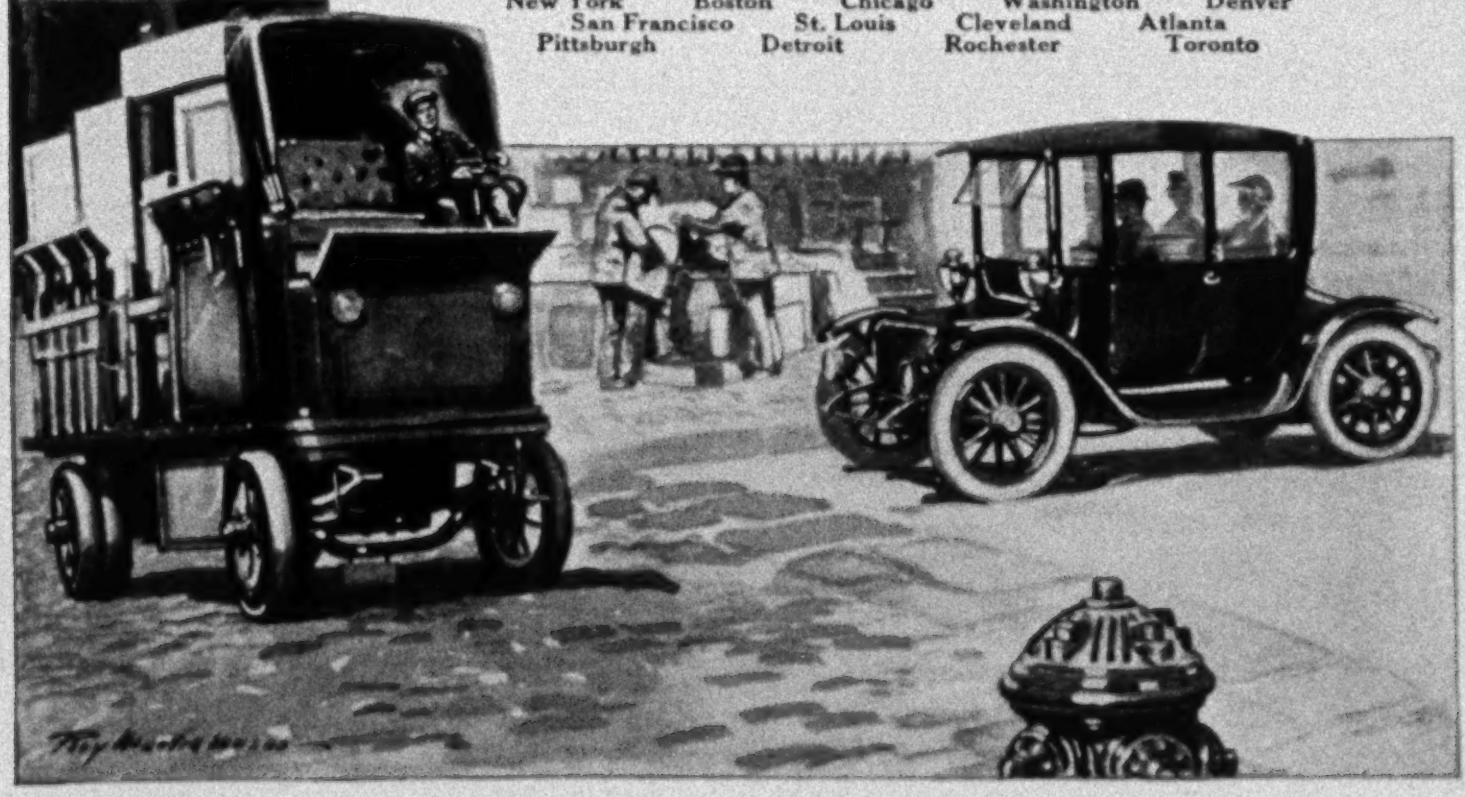
Remember that there is an "Exide" Battery perfectly suited to the needs of *your* car—for the sake of *good service* see that you get it.

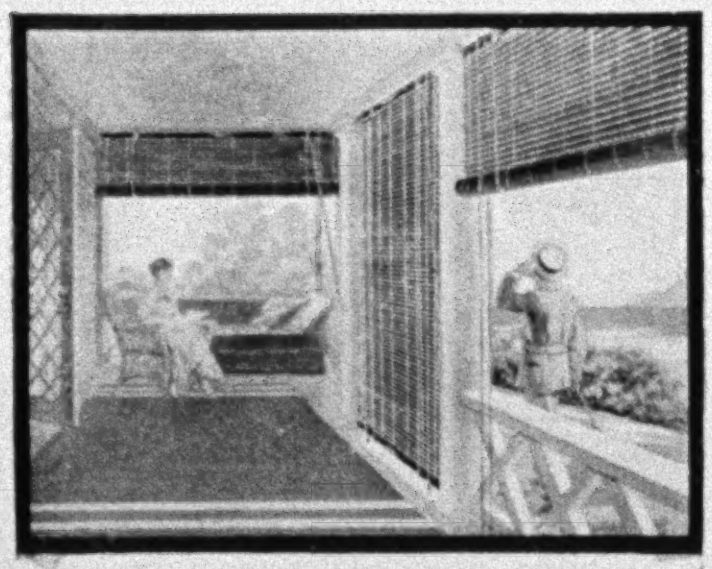
THE ELECTRIC STORAGE BATTERY CO.

The oldest and largest manufacturer of Storage Batteries in the country

1888 PHILADELPHIA, PA. 1916

New York Boston Chicago Washington Denver
San Francisco St. Louis Cleveland Atlanta
Pittsburgh Detroit Rochester Toronto





Go Home to Your Cool Porch

No matter how hot the day, your porch will be cool and restful if it is protected from the sun by

1916 Model

Vudor

Reenforced

Porch Shades

VUDOR Safety Wind Devices prevent Shades from flapping in the wind and take all wind pressure off the Shades. New VUDOR Cord Slides do away with galvanized or iron pulleys and make Shades roll up easily. We use VUDOR permanent oil stain, instead of the cheap, "change color" paint that is used on imitations.

Write for Booklet

Learn how at little cost you can convert your porch into a shady, secluded living room or a breezy, out-of-door sleeping room. Except in a few cities, we sell only *one single* store. Write us for booklet and name of *that store*, and get *genuine "last for years"* Vudor Porch Shades.

Aluminum Trade Mark exactly like this is attached to top and bottom moulding. It saves you from imitations and counterfeits.

TRADE Vudor MARK
PATD JAN. 5. 1904. OTHERS PENDING
PORCH SHADES
HOUGH SHADE CORPORATION
271 MILL ST., JANESVILLE, WIS.

Lasts for Years and why——

—first, because extra-deep corrugations make Witt steel 29 times stronger than plain steel and safe against the ashman's roughest handling;

—second, because a special galvanizing process makes Witt's resist rust and the fiercest ravages of the weatherman.

Look for the Yellow Label

Sanitary, too. Tight-fitting lid seals Witt's like a vault. Odors can't get out; dogs, flies, rats, roaches can't get in. Try Witt's this time. Write for booklet and name of your nearest Witt dealer.

THE WITT CORNICE CO., Dept. B, Cincinnati, Ohio

Witt's Can and Pail

"Mum"

(as easy to use as to say)

takes all the odor out of perspiration

Hot weather embarrassment is easy to prevent. A touch of "Mum" here and there keeps the body fresh and sweet from bath to bath.

"Mum" is a snow-white disappearing cream that neutralizes the odors of perspiration and other body excretions.

Does not check perspiration—that would be harmful.

25c—Sold by 9 out of 10 drug-and department-stores.

"MUM" MFG CO 1106 Chestnut St Philadelphia

TIRES OF PRESTIGE

* * *

OBSERVE the giant CORDS pictured below!
—Each Cord *strong* enough to support a Man's weight!

—So strong indeed, that only TWO (2) layers of this flat, rubber-impregnated, Cord are used in any Silvertown Tire.

These two layers of giant CORD,—with a layer of live Rubber between, to prevent friction,—have 50% to 75% more strength than had the 5 to 7 layers of Thread (or Thread-Fabric) we formerly used in our "Palmer-Web" Auto Tires of 1906 to 1913.

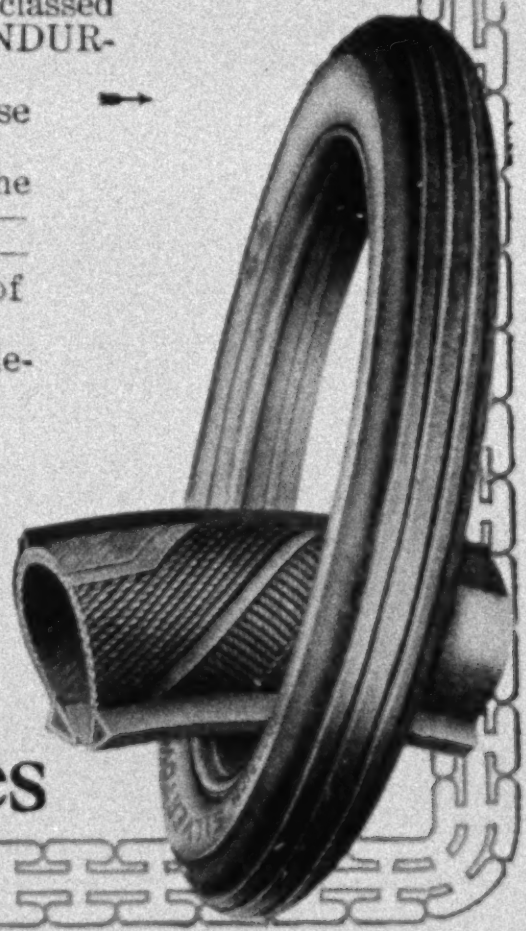
That "Thread-Fabric" Tire we *abandoned* in 1913.

Because Silvertown CORDS so far outclassed "Thread-Fabric" Tires in Strength and ENDURANCE,—which means Mileage.

No other Tires in America have these Anchored CORDS in them.

So,—if you would give to your Car the Prestige of genuine CORD Tire equipment,—with *17% more Net-power* to your Motor,—and *25% more Mileage* from each *gallon* of Gasolene, do this:—

See that the double-diamond Trade-Mark, in red Rubber, (as per arrow above) is on *your* Tires, and that they are branded as follows:—



Silvertown Cord Tires

A citizen of the world.

It went with Peary to the north pole, packed as a necessity along with the pemmican.

It moves in the best circles—including the arctic.

Rameses.

They call it "The Aristocrat of Cigarettes," and it travels with real men, in snow hut or bamboo shack, by land or sea.

There must be something very different about Rameses which makes men of discrimination and experience select it with critical care, smoke it with constant satisfaction, and recommend it as an act of real friendship.

All over the world "Nobody ever changes from Rameses."

STEPHANO BROS., Inc.
PHILADELPHIA

YOU can make your porch the favorite gathering place for all the family—a shaded, secluded refuge from the summer sun, an ideal sleeping room on summer nights, by equipping it with

AEROLUX
NO-WHIP
PORCH SHADES

Made of Aerolux Splint-Fabric, they shut out sun, yet let in light and air. **Aerolux No-Whip Attachment**, an exclusive feature, prevents whipping in the wind. Furnished in different grades and colors at moderate prices. An architectural adornment to any home.

Aerolux Splint-Fabric Awnings do not absorb and retain heat, but keep it out. ***Write for illustrated catalog.***

THE AEROSHADE CO., 521 Oakland Ave., Waukesha, Wis.

with 3-in-One Oil. It will make door hinges work noiselessly. For longer wear and easier work use 3-in-One on your—

Sewing machine, typewriter, talking machine, ice-cream freezer, bicycle, skates, music box, lawn mower, cream separators, clocks, locks, hinges, bolts, catches, pulleys, scales, scissors, and everything else *around your home* that ever needs oiling.

3-in-One is a clear, light oil preparation that cuts out all dirt and never gums or cakes. It lubricates perfectly every action part and prevents wear. No grease; no acid.

3-in-One also cleans and polishes all wood and metal surfaces—absolutely prevents rust and tarnish, indoors and out.

FREE Write for generous *free* sample of 3-in-One today. Give it a good, hard test.

Sold everywhere in 3-size bottles: 10c. (1 oz.), 25c. (3 oz.), 50c. (8 oz., ½ pint). Also in new Handy Oil Can containing 3½ ozs. of oil, 25c.

THREE-IN-ONE OIL CO.
42 UM. Broadway New York City

Napoleon *was* deathly afraid *of a* Razor

THE Emperor Napoleon never permitted anyone near him with an open razor. He did his own shaving and, owing to a sensitive skin, never could get a razor that pleased him. The one that annoyed him least was picked up during the Peninsular Campaign and had a blade of Saracen steel.

Today nearly all the World's Rulers use a Gillette Safety Razor. The latest convert is Yuan Shih k'ai, the great man of China.

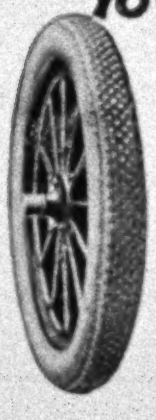
Another is the Premier of New Zealand.

In the present war the Gillette is used by the leading Generals and by some 3,000,000 men in the trenches and on all fronts.

The Gillette shave is quick and cool, safe and sanitary. It is velvet-smooth, no matter how wiry the beard or tender the skin. Adjust the handle for a light or a close shave. A keen, fresh blade is always ready. No stropping—no honing. Prices $5 to $50. Blades 50c. and $1 the packet. Dealers everywhere.

GILLETTE SAFETY RAZOR CO.
BOSTON

Don't Throw Away Your Worn Tires



For over three years European motorists have been getting from 10,000 to 15,000 miles out of their tires by "half-soling" them with Steel Studded Treads

In eight months 20,000 American motorists have followed their example and are **saving $50 to $200 a year** in their tire expense.

We ship on approval Without a cent deposit **prepay the express** and allow you to be the judge. **Durable Treads** double the life of your tires and are sold under a **signed guarantee for 5,000 miles without puncture.** Applied in your own garage in thirty minutes.

Special Discount offered to motorists in new territory on first shipment **direct from factory.** A postal will get full information and sample within a week. **State size of tires. Don't wait—write today.** Address the nearest office.

The Colorado Tire & Leather Company
637 Tread Bldg., Denver, Colorado
F37 Transportation Bldg., Chicago
720-376 Woolworth Bldg., New York

POMPEIAN OLIVE OIL

ALWAYS FRESH

Realize that Olive Oil cannot remain sweet and pure indefinitely—as tinned vegetables; that it is a commodity that should be handled with the same care as dairy products. Fresh eggs, fresh butter, sweet milk—and Pompeian Olive Oil—the up-to-date housewife places them in the same category. Sold everywhere.

THE POMPEIAN COMPANY
GENOA, ITALY BALTIMORE, U. S. A.

The Big Tree Panorama

ADDITIONAL copies of the beautiful picture of the giant tree, "The Oldest Living Thing," included as a photogravure panorama in the April, 1916, issue, can be obtained, unfolded, on artist proof paper, ready for framing, postpaid in the United States, at 50 cents each.

Likewise copies of the wonderful panorama, "The Palace of the Lama, Lhasa, Tibet," which appeared in the March issue of the GEOGRAPHIC, can be furnished at 50c. each, ready to be framed.

The supply of these remarkable pictures is limited; therefore it is advisable to order now.

Department H
National Geographic Magazine
16TH AND M STREETS N. W.
Washington, D. C.

RECOMMENDATION FOR MEMBERSHIP

in the

National Geographic Society

The Membership Fee Includes Subscription to the National Geographic Magazine

DUES: Annual membership in U. S., $2.00; annual membership abroad, $3.00; Canada, $2.50; life membership, $50. Please make remittances payable to National Geographic Society, and if at a distance remit by N. Y. draft, postal or express order.

Please detach and fill in blank below and send to the Secretary

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To the Secretary, National Geographic Society,
Sixteenth and M Streets Northwest,
Washington, D. C.:

I nominate _____

Address _____

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for membership in the Society.

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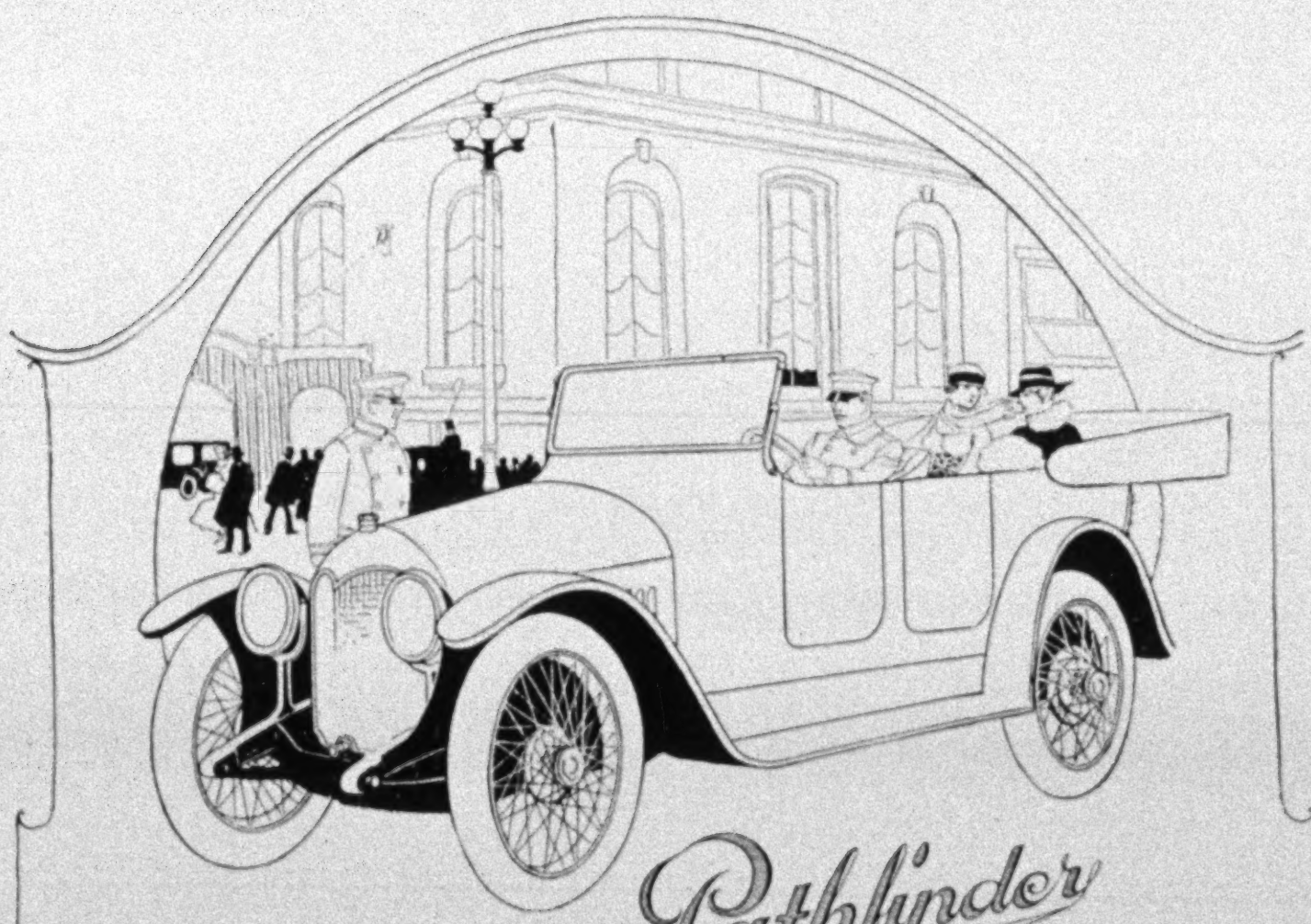
6-16 (Write your address)



Pathfinder

the "GREAT" King of Twelves

Designed by Feilcke
Built in the Shops of Pathfinder

A luxury of motion so smooth and such an utter absence of effort that you are unconscious of any mechanism. A quiet dignity and beauty of line that gives that much envied "grand air" of distinction, and behind it all, the certainty of faultless performance under any and all conditions of road and traffic. Could more be asked of a motor-car?

Seven Passenger Touring Car, $2750
Clover-leaf Roadster with Concealed Top $2900
Special Enclosed Bodies up to $4800
All F. O. B. Indianapolis
Complete Details and Catalog on Request

The Pathfinder Company

Indianapolis, — U. S. A.

"Mention the Geographic—It identifies you."

Washington—The Nation's Capital

By WILLIAM H. TAFT, Former President of the United States

and

JAMES BRYCE, Former British Ambassador

---

35 Pages of Color Illustrations

59 Pages of Half-Tones, 2 Large Panoramas, and a Map in Color

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Washington—The City of Magnificent Distances, destined to be the most beautiful capital in the world—is a source of pride to every American, for Washington belongs to each and every citizen of the Republic.

William Howard Taft, former President of the United States, and James Bryce, former British Ambassador, have written their impressions of Washington, and they are especially qualified to speak authoritatively because of their long residence in and close study of the Nation's Capital.

The book contains a most wonderful series of illustrations in color, 35 full page plates in four colors, 2 large panoramas, and 1 map, also in color, made from the remarkable plans, drawings, and renderings of the Fine Arts Commission, now on exhibition at the Panama-Pacific Exposition. These pictures are pronounced the most beautiful collection of views of a city ever made, and there are 59 pages of half-tone plates of Washington scenes, in addition—a total of 94 illustrations.

To every one who has visited Washington or expects to do so, this book will be most valuable because of the intimate descriptions by Ex-President Taft and Lord Bryce of the city and surrounding country so dear to every American and because of the amazing collection of illustrations in color and half-tone, which picture the beauties of Washington.

The volume is composed of two articles and illustrations which appeared in the Geographic Magazine, containing 116 pages, is available in two attractive bindings, and offers an ideal remembrance. The edition is limited, and as this remarkable souvenir book of Washington will go out of print rapidly, you are advised to order now. Use blank below and mail at once.

CUT ON THIS LINE

DEPT. H, NATIONAL GEOGRAPHIC SOCIETY,
16th and M Streets, Washington, D. C.

_____, 1916

Please send _____ copies of **"Washington—The Nation's Capital,"** bound in _____

for which I enclose herewith _____ dollars. (Domestic postage paid.)

If several copies are desired, write names and addresses and send with your card.

Name _____

Street Address _____

City and State _____

Bound in Royal Buckram, postpaid in U. S., $1.50
Bound in Full Leather, postpaid, $2.00 (De Luxe Edition)

6-16

HUDSON RIVER BY DAYLIGHT

No better way to view the lovely scenery of this historic river than from the decks of a swift, palatial Day Line Steamer.

"Washington Irving" **"Hendrick Hudson"**
"Robert Fulton" **"Albany"**

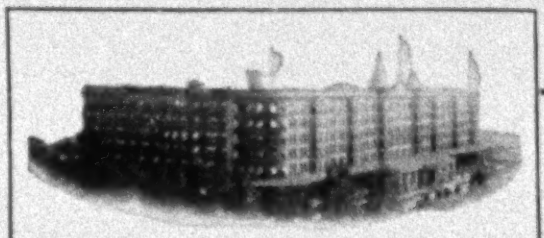
The fastest and most beautifully appointed river steamers in the world.

Service daily except Sunday, between New York and Albany. All through rail tickets via New York Central or West Shore R. R. accepted on all boats. Orchestra, restaurant.

Send 4c. in stamps for summer literature

HUDSON RIVER DAY LINE

Desbrosses Street Pier **New York**



Chicago Beach Hotel

The best of outing pleasures and the advantages of the city await you here on this great inland seashore. Bathing, sailing, canoeing, golf, tennis, riding—all that makes a summer holiday complete.

Frequent informal dances. Every room outside, and cooled day and night by the refreshing lake breeze. American or European plan. The quiet of the country, yet only ten minutes from shopping and theatre districts. Write for rates and reservations.

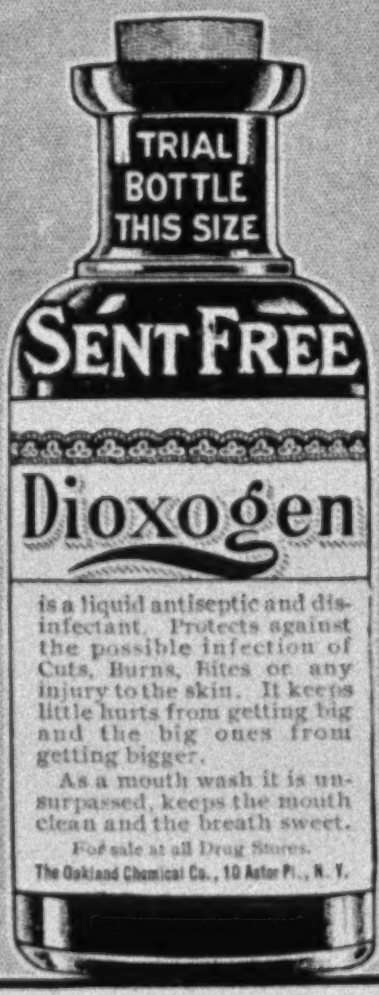
CHICAGO BEACH HOTEL

Hyde Park Boulevard on the Lake Shore CHICAGO

Hess-Ives Micro Camera

HERETOFORE your photographs retained only the form of the subject; today, with this new photographic marvel, you can hold in permanent form all of nature's colorings as well. As many prints as you want—not mere transparencies. Let us send you a catalogue.

Hess-Ives Corporation
1201 Race Street
Philadelphia


TRIAL
BOTTLE
THIS SIZE
SENT FREE
Dioxogen
is a liquid antiseptic and disinfectant. Protects against the possible infection of Cuts, Burns, Bites or any injury to the skin. It keeps little hurts from getting big and the big ones from getting bigger.
As a mouth wash it is unsurpassed, keeps the mouth clean and the breath sweet.
For sale at all Drug Stores.
The Oakland Chemical Co., 10 Astor Pl., N. Y.

DEAF?

Read What Dr. Upham Says of the

1916 Acousticon

W. C. Upham, M. D., of Washington, D. C., writes us—"Where I could not possibly hear a word of conversation, with the ACOUSTICON I hear distinctly. No person who is hard of hearing should fail to get this Instrument if possible to obtain it."

The unstinted praise of 250,000 satisfied customers and many letters like the above from eminent physicians lead us to urge you and every deaf person, entirely at our risk, without a penny of expense, to give the 1916 ACOUSTICON a thorough trial in your own home, absolutely and entirely

No Deposit FREE No Expense

All you need to do is to write saying that you are **deaf** and will try the ACOUSTICON. The trial will not cost you one cent, for we even pay delivery charges.

WARNING! There is no good reason why everyone should not make as liberal a trial offer as we do, so do not send money for any instrument for the deaf until you have tried it.

The ACOUSTICON has improvements and patented features which cannot be duplicated, so no matter what you have tried in the past, send for your free trial of the ACOUSTICON today and convince yourself—you alone to decide. Address

GENERAL ACOUSTIC CO., 1311 Candler Bldg., New York
Toronto, Ont. Office, Royal Bank Bldg.

STERLING

Give your child a Sterling Piano at the beginning of music lessons—it affords the young student correct standards of tone and touch, establishes a degree of musical taste that is a constant source of uplift, and remains an object of increasing pride year to year.

Cased beautifully; priced moderately. Delivery direct from factory or through authorized dealers. BOOKS FREE.

THE STERLING CO., DERBY, CONN.
Founded 1866 by Chas. A. Sterling

Trees for Midsummer Planting

Evergreens and shade trees that will save ten years may be planted NOW. Pines 12 ft. high may be shipped 1,000 miles. Satisfactory growth guaranteed.

Get seclusion by planting these evergreens on boundary lines or facing busy streets.

Little pines by the thousand for reforesting. Let us move large evergreens from your vicinity in July.

Send for Catalogue Today

Hicks Nurseries
Westbury, L. I.
Dept. N.

Nothing Ever Tasted Better

after that ride in the open air, over hot, dusty roads—a cool, clean, fresh, appetizing lunch and ice-cold drinks—right out of the

Hawkeye Basket Refrigerator

Nothing ever tasted better. Just the thing for motor, hunting, fishing, and camping tours. Keeps food cool 36 hours. Handsome, lightweight, sanitary, durable. Nickel-plated interior. Priced as low as $4.00.

Ask your dealer. If he can't supply you, we'll ship direct on 30 days' trial. Write for Booklet C today.

Burlington Basket Mfg. Co.
Burlington, N. E. Iowa

This Magazine is from Our Presses

Judd & Detweiler, Inc.

Master Printers

420-422 Eleventh Street — Washington, D. C.

The Prophy-lac-tic Tooth Brush

Most of your friends use it and *profit* by it

SOMEWHERE in your home, in your business, in your life, there is a big place for Corona—the unfailing friend of those who must or should write.

CORONA

The Personal Writing Machine

because of its sympathetic response to their thoughts, has endeared itself to more than 70,000 users.

Pen-writing is doomed—every one who can spell should own Corona. If you study, have club or other social duties, or are literary—you particularly need the help and inspiration Corona gives.

Coronatyping is the new social accomplishment. It is simple, easy, pleasant, and a joy to the recipient.

Corona weighs but six pounds, and a sturdy, sightly carrying case accompanies it, so that it may always accompany you.

Corona complete costs $50

Ask for Catalogue No. 27 and we will send with it "Proof of the Pudding," telling of those who use Corona and what it does for them.

Corona Typewriter Company, Inc., Groton, N. Y.

New York Chicago San Francisco

Agencies in all principal cities

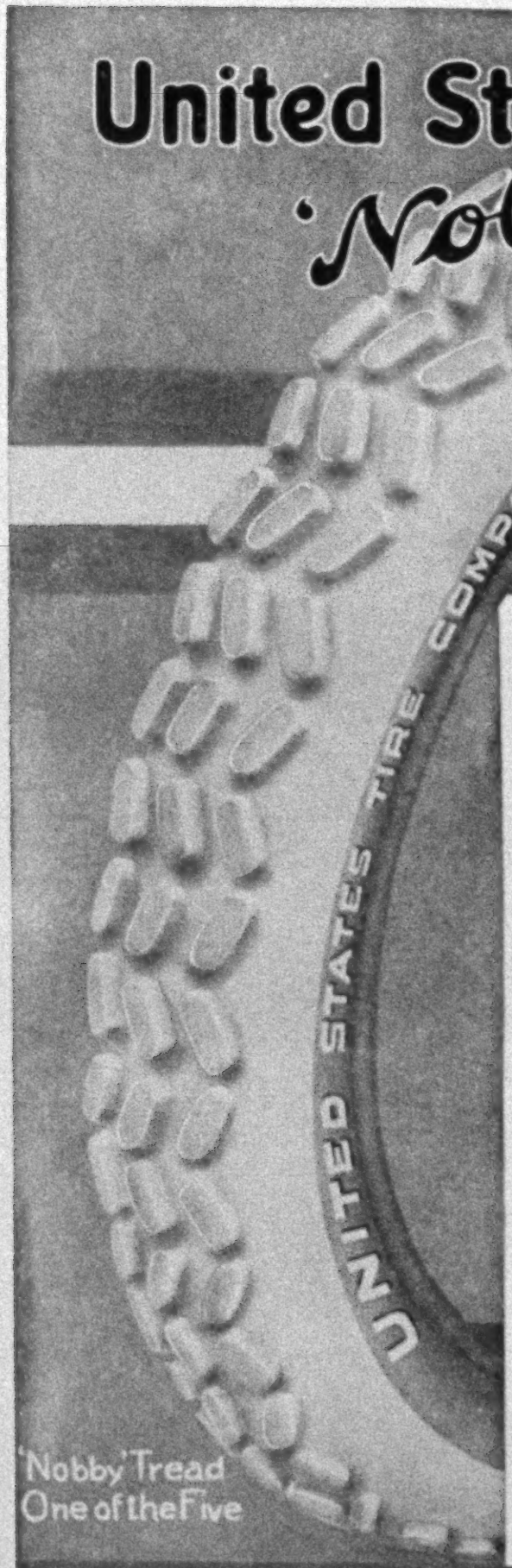
Packard
TWIN-SIX

IN PLAIN SPEECH, that car is best which will start quickest, control easiest, ride smoothest and run longest. To obtain this result, the PACKARD MOTOR CAR COMPANY a year ago created the *twelve-cylinder engine*, and provided in the *PACKARD TWIN-SIX* greater safety, smoother action, longer wear—with the elegance of a really fine carriage. By its performance in the hands of more than 6000 owners, this latest Packard has made the twelve-cylinder car the world's standard of automobile sufficiency and value.

Thirteen styles of open and enclosed bodies. Prices, with any open body, f. o. b. Detroit — The 1-35, $3150.00; *the* 1-25, $2750.00

ASK THE MAN WHO OWNS ONE

United States 'Nobby' Tread Tires



Big, Thick Knobs— The Real Anti-Skids

You get real anti-skid protection from a car equipped with 'Nobby' Tread Tires.

The big, thick, resilient knobs take hold of the road-surface with a real grip.

Besides—no loss of traction—quick response to the clutch and accelerator—less wear on the tire through friction.

'Nobby' Treads were the first successful anti-skids—and are still the first.

'Nobby' Treads are the largest selling very high-grade anti-skids in the world.

The 'Nobby' is one of the five United States 'Balanced' Tires which meet every motoring condition of price and use.

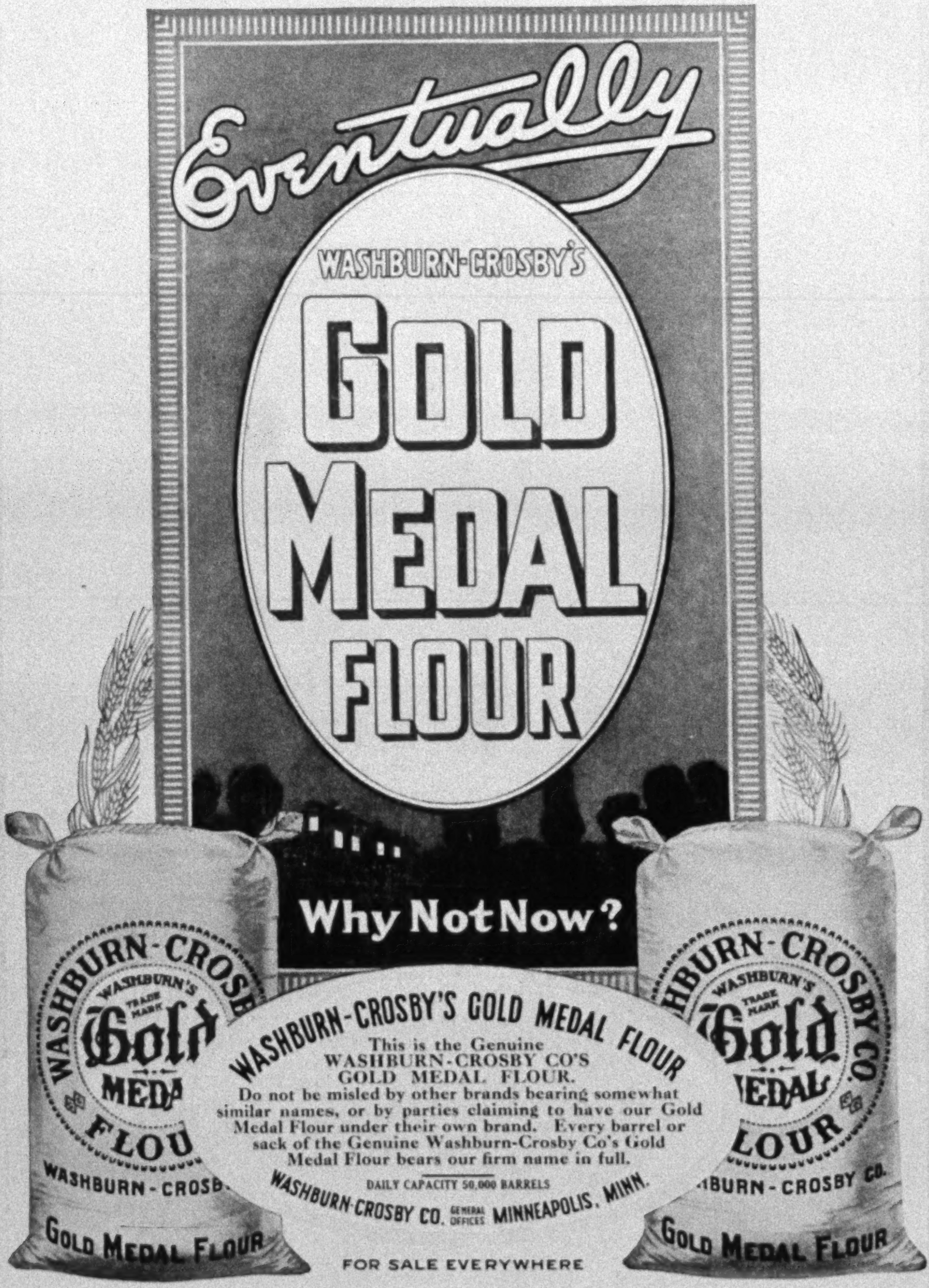
Ask the nearest United States Tire Dealer for your copy of the booklet, "Judging Tires," which tells how to choose the particular tire to suit your needs.

United States Tire Company

'Nobby' 'Chain' 'Usco' 'Royal Cord' 'Plain'

"INDIVIDUALIZED TIRES"

UNITED STATES RUBBER COMPANY
US
RUBBER SYSTEM
AND ASSOCIATED COMPANIES


Eventually
WASHBURN-CROSBY'S
GOLD MEDAL FLOUR
Why Not Now?
WASHBURN-CROSBY'S GOLD MEDAL FLOUR
This is the Genuine
WASHBURN-CROSBY CO'S
GOLD MEDAL FLOUR.
Do not be misled by other brands bearing somewhat similar names, or by parties claiming to have our Gold Medal Flour under their own brand. Every barrel or sack of the Genuine Washburn-Crosby Co's Gold Medal Flour bears our firm name in full.
DAILY CAPACITY 50,000 BARRELS
WASHBURN-CROSBY CO. GENERAL OFFICES MINNEAPOLIS, MINN.
WASHBURN-CROSBY'S
TRADE MARK
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GOLD MEDAL FLOUR
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